



B. Ryabinin

**ACROSS
THE
URALS**

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CONTENTS

THOSE BAFFLING STONES

The First Trip. In the Darkness of Eternal Night

Do Stones Grow?	9
The Vanished Lake	13
At the Edge of the Cave-in	14
Drip-Drip	17
An Underground Wanderer	23
Subterranean Castles	25
What the Caves Tell	31
A Subterranean Fine Arts Museum	33

The Second Trip. Reading a Stone Chronicle

How Stones Shoot	38
The Pine and the Chipmunk	40
Granite Bowls	45
Bowls Again	46
Sem Bratyev	52
The Mystery: Still Unravelled	54
Stone Giants	57
Nature's Geological Laboratory	63
A Stone Preserve	71

The Third Trip. The Urals Flings Open Its Storehouses

Treasures of the Stone Belt	77
The Thrill of the First Discovery	79
Mountains of Iron and Rivers of Fire	81
A Region Rediscovered	83
Kachkanar	85
Like Ships Sailing over Tree-tops	87
The Urals Forges Victory	91

A TOWN OF WORKERS' GLORY

The First Projection: Metallurgical	96
The Second Projection: Engineering	99
The Third Projection: Chemical	101
Through the Magnifying Glass of Time	103

A VOYAGE ABOARD THE MAYAKOVSKY

The voyage begins.—On the eve of great accomplishments.—	
The end of the Kama Fleet	109
How old is the <i>Mayakovsky</i> ?—Before a sea is born	114
Orel-Gorodok, former capital of the Stroganov domain.—	
Captain Pirozhkov's exploit.—A city of chemists.—	
A gift from the Permean Sea	121
Where rafts are made.—Kama forests.—The Vishera	128
Krasnovishersk of paper fame.—Polyudov Kamen.—	
The return trip	132
Cherdyn.—Ilya Lunegov.—Floating memorial	135
What was in the archaeologist's suitcase.—From the depths of the centuries.—Legendary Biarmaland	138
Pozhva, town of the first Russian steamships.—	
Last glance at the river	144
The Kama today.—The Kama Sea.—Oil islands.—Legend about the golden idol.—A look into the future	146

SILVER WINGS

On the track of old discoveries.—Little Red Riding Hood	167
The Grim Year of 1941	170
The Urals Aluminium Plant	172
The Battle for Aluminium	174
The Bogoslovsk Aluminium Plant	176

END OF THE TRIP

Sverdlovsk	183
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The Ural mountain range with its unique assortment of minerals runs 2,000 kilometres north and south, from the Kara to the Caspian Sea, and forms the traditional boundary between Europe and Asia.

With its manifold riches, my native Urals is like a gem which gleams with a thousand magic lights whatever way you turn it.

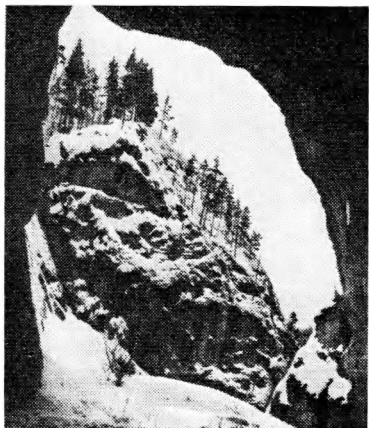
It is a land of science, industry and agriculture. It has hydropower stations, mines, ferrous and non-ferrous, chemical and other industries.

The Urals is synonymous with will-power and strength, work and dreams, with majestic landscapes and incalculable mineral riches.

This book does not contain exhaustive information about the Ural range. I simply wanted to describe the construction sites, forests and mountains which I had seen in the course of my voyages.

I invite you to make these trips with me so that you may come to sense the atmosphere of the Urals and appreciate its singular features and the great role which it is playing in the life of the Soviet Union.

THE AUTHOR



Those Baffling Stones



THE FIRST TRIP

IN THE DARKNESS OF ETERNAL NIGHT

Do Stones Grow?

It happened a long time ago. I was a topographer then and frequently conducted surveys in the remotest parts of the Urals.

On one such trip I stopped over in a small village hidden deep in the forest. Barely concealing whitish, crumbling rocks, a sloping meadow with a few huts on it crawled down to a noisy little river. Its banks were strewn with polished, rounded pebbles and the bed was clogged with rock debris. A bristling cap of hoary firs and pines covered the steep slopes. But scratching away the velvety, moist moss growing between the roots of the trees one could see the same cracked, time-eroded rock.

I spent the night in a peasant's hut. Whiling away the long evening hours by the light of a kerosene lamp we fell to talking and my host showed me exquisite articles with glittering facets which he had carved from the same dirty-white rock forming the surrounding mountains.

I delighted in the intricate workmanship of images of people and birds, a knee-boot and several eggs which even a hen would have failed to distinguish from real ones.

Tall and sinewy, with a forbidding look on his heavily-bearded face, the old man was a self-taught craftsman. His skilful hands breathed life into the

dead stone. To assist him in his work he had a home-made foot-driven lathe. But he was not the sole craftsman in the village. He told me that stone carving was an ancient trade of the villagers who combined it with tilling, their traditional occupation.

At daybreak he was already working in the field. I got up later and had just finished my breakfast when I saw him running into the yard. Without a hat, his hair dishevelled and covered with what at first glance looked like flour, he seemed to be shaken and frightened.

"Something terrible has happened," he shouted waving his arms. "Sivko, my horse, has fallen through the ground. That blasted rock has shifted again."

Hearing his yells his wife and son, a lad with a shock of blond hair, rushed out of the hut. The woman threw up her arms in a gesture of horror and began to wail. The youngster paused for a second and dashed to the field with me close on his heels.

The arid patch of ploughland, which had never yielded a bumper harvest, was just outside the village. Running along a furrow the lad stopped at a deep hole in the ground. He gazed at it with unconcealed curiosity. Stones and earth were still falling into the cave-in and lime dust was slowly settling on the bottom covering the debris and tufts of grass that had fallen into the hole with a thin white coating. A piece of rock, a fresh fracture gleaming in the sun, stuck out from one side of the cavity. Not a sound was heard but the buzzing of the dragonflies winging from the river, and the chirping of grasshoppers in a nearby meadow.

I picked up the whip, the only reminder of the mysteriously vanished Sivko.

Later my host told me how it all happened.

"I had just started ploughing. I think I made two



A Urals stone-cutter

or three furrows. Suddenly the earth began to tremble and with a rumble started to subside. As though someone was pushing it in. The dent cracked and fell through. I jumped aside just in time . . . but Sivko. . .” And he ruefully waved his hand.

I was amazed. Poor Sivko. It all sounded incredible. Yet the man himself saw nothing unusual in it.

“Sometimes these things happen several times a year. Usually cows fall through. The pasture is all holes and rocks. And the damned rocks keep cropping out.”

Once again I was surprised. Now, how on earth could that happen?

“What I mean is that they keep growing,” he explained. “And when a rock breaks through to the surface, the ground caves in. Just like today. After a time the earth gradually fills in the pit and grass covers it so that only a shallow hole remains. And right next to it a rock always sticks out. More and more rocks break through to the surface each year. In a word, they just go on cropping out.”

At first I was amused at the idea of stones growing like grass or trees. It just did not make sense. But after taking a look at the pasture I was prepared to take his word for it.

The whole meadow was pockmarked with round holes some of which were hardly noticeable while others were quite deep. Many were filled with rock debris, others with rain water and two or three had a dark vertical crack in them. A white stone fang protruded from the ground next to each hole, and the bigger the fang the deeper the hole and the more eroded its edges.

The pasture was studded with sharp rocks as though the earth was cutting teeth. And then I recalled something that had happened many years ago.

The Vanished Lake

We lived in a village near Kungur at the time. Each summer my father, a land surveyor, would work in the countryside and Mother and I would leave our home town and accompany him.

I used to spend days on end with the local boys on a meadow at a lake about half a kilometre from the village. We swam, revelled in the sun and in general behaved as teenagers are wont to behave when left to their devices.

It was a small lake and we could easily swim across it. But even the best diver could not reach its bottom. It was shaped like a plate: absolutely round as though plotted by a pair of compasses, with gently sloping banks covered by a trim carpet of grass through which rocks peeked out here and there. The meadow with occasional oval-shaped holes descended into a diminutive valley with a small river.

We ignored the river which was swift and cold. But the lake was a different matter. With the exception of rainy days we were always there from morning till late in the evening.

One day as we were basking in the sun after a long swim, one of us noticed that the water had ebbed somewhat. This extraordinary phenomenon naturally aroused our curiosity.

We began to watch. An even damp ribbon of land appeared along the bank.

"I think it's drying up," said one of us hesitantly. We all laughed. "How could a lake dry up so fast?"

At someone's suggestion we stuck a stick into the water so that its tip was level with the lake's surface. Less than half an hour later the water had receded to such an extent that it became completely exposed.

There was no longer any doubt that the level of the water was dropping rapidly.

For a long time we remained on the bank awed by what was taking place before our eyes.

The following morning we hurried to the lake earlier than usual and could not find it. The lake had vanished as though it had never existed. Instead we saw a deep and broad basin with silt-covered slopes and a rapidly drying puddle in the centre. Next to the puddle yawned a black hole into which a thin muddy stream was disappearing with a gurgling sound.

At the time I could not understand how a whole lake could have drained out of its basin as water from a rusty pail. But now, standing at the edge of the newly-formed hole which had become poor, hard-working Sivko's grave, it occurred to me that there could be a connection between the two events.

At the Edge of a Cave-In

Some time later chance brought me to Nizhniye Sergi, a small town in Central Urals famous for its 18th-century ironworks and a health resort of the same name.

Making the acquaintance of a local inhabitant by the name of Mikhail Zasypkin, I set out for a walk in the neighbourhood with him. Leaving the dusty Nizhniye Sergi behind we crossed the narrow Bardym River and entered a fragrant fir wood. A winding path climbed up a steep hill and then ended abruptly and we continued our way weaving in and out between the trees.

Our destination was a cave-in which, in the opinion of local inhabitants, presented a remarkable, even an unusual sight and which they strongly recommended me to see.

Suddenly Mikhail Zasyarkin swerved into the thicket. Struggling through the clutching branches I reached his side and froze in my tracks.

We stood at the edge of a huge slump hole not less than 60 metres in diameter. Risking our necks we clambered down its steep slopes grasping at rare bushes and tree roots. It was like being on the bottom of a deep well. Looking up we saw a patch of blue sky, while the heavy shadow cast by the tall firs and pines closely ringing the hole made the place look particularly dark and sombre.

Beneath an overhanging rock gaped an aperture which could well have been some beast's burrow. A clinging, damp mist slowly oozed out of it and rising dreamily melted in the transparent air of the July morning. The wet and rancid smell which emanated from the black orifice sent a chill down my spine. Something akin to horror filled me at the sight of the cave-in. But it only whetted my curiosity already stimulated at the thought of the mysterious subterranean world which I imagined existed beyond this void.

"It would be awfully interesting to take a look inside."

"An expedition came here some years ago, don't remember the year," Zasyarkin said. "They went inside. They also asked me to be their guide."

He was a loquacious man and willingly talked about his native Urals which he knew so well. He told me that the "burrow" descended sharply for about two hundred metres. Then it expanded to form a large cave. The bottom of the cave was strewn with fine sand and there was a lake with clear icy water at one end.

The expedition found a half-rotted raft there and it was quite possible that the cave continued beyond the lake.

No one ventured to use the raft, however, and the expedition terminated its investigations.

Listening to him I recalled *Journey to the Centre of the Earth* by Jules Verne, whose books enthralled me in my boyhood. Perhaps we were standing at the beginning of a road leading to the unexplored depths of the earth? Who could say how long it was and where it ended, and how it appeared in the bowels of the earth?

I also remembered poor Sivko, and imagined how his master, if he were with me, would say, gazing at this cave-in, that here too stones "cropped out".

Could it be that he was right, that stones actually grew?

No, of course not, the idea was too preposterous for words. Old people were simply unable to offer a scientific explanation to puzzling natural phenomena and were inclined to invent things.

Nevertheless, I was still floating in a sea of doubt. Lost in thought I did not notice that we had left the woods far behind, and were going downhill. Zasyplin's voice brought me back to earth.

"Do you want to drink? It's pretty hot today."

A thin spring of clear water spouted from a crevice at the foot of the hill. Cupping his hands Zasyplin took a swallow.

"Couldn't be better," he said wiping his lips and then cupped his hands again.

The water was invigorating.

"Have you tasted our resort water?" He had in mind the sulphurous water from a spring flowing at the foot of a hill where the Nizhniye Sergi resort stands. "You must try it. Its salubrity is a byword. People come here on crutches and mark the end of their treatment by dancing. It works miracles, but I must say that it doesn't smell too good and is terribly salty."

"Salty?" I asked absent-mindedly.

"I should say so, and smells of rotten eggs, too, what with all the salts that are dissolved in it. . . ."

"And where had it dissolved them?" I pondered. Suddenly it occurred to me that I had hit upon the answer. But it was only after additional observations that I became confident in the correctness of my conjecture.

Drip-Drip

That year I spent my holidays with a group of tourists on a sightseeing tour of the Southern Urals. Our itinerary included a fairly long trip along the river Belaya which is particularly lovely and even wild and dangerous in its upper and middle reaches.

After a week of hot cloudless days, the weather changed abruptly and a long rainy spell set in.

It grew cold. Darkening, the cliffs on the banks made the river seem narrower.

The weather was typical of the Urals. One moment the sun shines brightly, the next it rains in torrents and a hot day suddenly grows bitterly cold. In fact, one never knows what sort of weather there will be in the evening.

A dreary drizzle blotted out the surrounding hills and forests. In search of shelter we made for the right bank scanning it for a convenient place to pitch camp.

A white gluey mist curling from behind a cluster of bushes attracted our attention. Somewhere nearby, in the wet gleaming verdure, a rivulet gurgled merrily. Its water was very cold and we could feel its invigorating breath. We pitched camp beyond the bushes on a small glade with a carpet of grasses and field flowers. The mist we had noticed while on the

river emanated from a craggy limestone cliff that dominated the glade. "What did it all mean?" we wondered.

Rounding a salient at the foot of the tree-topped hill we found a dark opening wide enough to admit a pair of horses. It seemed to challenge the traveller to show his pluck and explore the depths of the hills.

Indeed it was the entrance to the famous Kapova Cave. We could feel its sepulchral cold. Two melodious streams wound their way out of the orifice and fell into the river.

The Kapova Cave, one of the least explored and difficult of access, is hidden in the primeval forests covering the southern spurs of the Urals Range, far from roads and human habitation, and has remained almost wholly as nature made it. It can be reached only by sailing in a boat along the Belaya which is swift and abounds in rapids in its upper reaches.

After breakfast the following morning, armed with birch-bark torches, we set out to explore the cave. The dark vault swallowed us and we found ourselves in a delightful grotto almost circular in shape. Daylight penetrated into it and we saw the smooth shining surface of a lake.

"Why, there's fish here."

Several silver-scaled gudgeons darted away in fright through crystal-clear water. Fish are not usually found in cave lakes. But in this case they must have been brought by flood waters. All those who had ever inspected Kapova Cave noted the presence of fish in the lake.

The grotto was the hall of an underground palace. The weak light gradually faded as we moved deeper and deeper into the hill along a tortuously twisting rocky corridor. Soon we reached another hall which was so high that its ceiling was lost in the darkness.

After a brief look around we continued our journey scrambling over heaps of slippery wet rocks. Stalactites resembling mammoth icicles descended on us from the gloom. In the pinkish light of our crackling torches they seemed to move and collide in an eerie dance.

It was relatively warm in the cave. Rising from the floor to meet the stalactites were their still thicker counterparts, stalagmites, conical deposits of limestone. In places there were so many of them that we felt ourselves lost in a fantastic dead forest.

"Shush," someone said softly.

We halted. It became so quiet that we felt a tingling in our ears.

Not a sound.... But what's this?

Drip-drip. And again drip-drip, this time somewhere in front of us. Drip-drip.

No, it was not so quiet in this kingdom of eternal night. Water dripped from the walls and ceiling and the ring of the drops striking on stone punctuated the silence like the tapping of a metronome.

So that is why the cave is called Kapova, for *kap* in Russian means drip.

Further the labyrinth of passages became more involved with numerous defiles leading to the left and right. Apertures darkened in the ceiling, too; evidently the cave had a second and even third floor. Honey-combed with voids, cracks and fissures the walls reminded one of porous Swiss cheese with gleaming drops of moisture.

Danger seemed to lurk at every step. We physically felt the weight of the huge rocks suspended overhead and expected them to tumble down at the slightest touch. But a sharp, indescribable feeling of curiosity spurred us on.

Though it is not easy to estimate distance underground, we must have covered several kilometres.



Ufa. A bridge across the Belaya

Still there seemed to be no end to the suite of grottos and wide and narrow galleries.

Not to lose our way in the numerous tributary passages we marked our way with green twigs and bits of birch-bark which we had taken along expressly for that purpose.

Climbing up a heap of stone debris we reached the "upper floor", and found ourselves in a wide straight corridor resembling a working drift in a mine. Our footsteps evoked a resonant echo. Leaving my companions behind I clambered up another heap of rocks and accidentally dropped my torch which immediately went out. For a minute I was all alone in abysmal darkness. It was not at all a pleasant feeling. I was just about to call my companions when I saw a weak glow ahead. A few steps brought me close to what I took to be a large lake whose surface radiated a soft blue glow. But when my companions



A bivouac

arrived with their smoking torches the glow vanished.

I threw a stone into the water. There was no sound of a splash. It was as though it had fallen into a void. Amazed, we timidly drew nearer the lake only to discover that we were standing at the brink of a huge cave-in. Another step would have been fatal. There was no lake. It was an optical illusion,

a mirage of the sort that is often observed in deserts and at sea.

But where did the glow come from?

Evidently below us ran the first corridor that was connected with the surface entrance and which was the source of the dim reflected light.

Our torches were burning low and it was about time to retrace our steps.

But no matter how exciting an underground journey may be, it is a relief to be back on the surface, see the sky overhead and breathe the fresh breeze floating in from the river. While we were in the cave the clouds had melted away and the sun played joyously on the majestic cliff guarding the entrance to the subterranean castle and the glade with our tents and the swift, ever-hurrying Belaya.

We soon had the kettle singing over the fire. Sipping tea we recalled all the details of our underground trip, a bit frightening of course, but all the more exciting because of it.

That day it was my turn to scrub the kettle and I noticed that its sides were covered with a hard whitish incrustation. It was lime, and that meant that the spring from which we drew the water was not as clean as it appeared at first glance. Dissolved in it were microscopic particles of limestone forming the cliff and the hill whose depths we had just explored.

Immediately I remembered the cave-in at Nizhniye Sergi, the spring from which Zasytkin and I had quenched our thirst on our way back from the forest and the pockmarked pasture.

Undoubtedly all these phenomena were closely related. All of them were links of a single chain. Now I was absolutely sure of that.

Gazing meditatively at the river bank it occurred to me that in the oblique rays of the setting sun all the unevennesses on the hill's brow made it resemble

the wrinkled face of an old man (and indeed they were wrinkles imposed by time). In many places jagged cliffs protruded from the green carpet covering the slopes. And again I heard the old man in the forest village saying: "The damned rocks keep cropping up."

An Underground Wanderer

Back home I dived into books and they fully confirmed my assumptions.

Yes, the old man erred. Rocks do not and cannot grow. On the contrary they fall apart dying a slow death and finally disappear from the face of the earth. And if at times a rock does appear on the surface it does not happen because it has grown to a large size and there is not enough room for it underground, but because water is constantly eroding the depths of the earth.

This is how it happens.

Streams and small and large rivers flow deep below the surface of the earth. How do they originate?

Falling on the ground raindrops collect into streams which percolate through the loose ground and sand and are brought to a stop upon encountering clay, granite or some other impermeable rock known as the water-resisting layer. Gradually water accumulates over it. "A lake is formed drop by drop," says an old proverb. This is manifested most strikingly underground.

Water, as you know, rarely remains immobile. All it needs is the tiniest of cracks to drain away and move to another place.

Once accumulated, water itself searches for an outlet. In this it is assisted by fissures. Finding a duct water widens it and then begins to wander deep be-



Nizhniye Sergi Resort in winter

low the surface of the earth dissolving and washing away rocks and minerals.

In its peregrination the underground wanderer gradually breaks out to the surface again either as a spring, like the one from which Zasytkin and I drank, or a river, and sometimes as a thousand streams. In the Bzyb Canyon in the Caucasus there are the famous Weeping Cliffs with water dripping right from the rocks, or rather from microscopic ducts in the limestone. Depending on the minerals dissolved in it, subsurface water can either be bitter or salty or have a sulphur smell like the Nizhniye Sergi medicinal spring. The USSR abounds in mineral springs, of which the most famous are in the Caucasus. There are numerous springs in the Urals; the oldest are Klyuchi, Kuryi, Nizhniye Sergi and Izhevsk

which are the sites of large health resorts. Others were discovered later but have already proved their worth.

A spring gushing with great force was discovered near Talitsa, a small Urals town, after the Second World War. It turned out that its sodium chloride water effectively cured people suffering from liver and kidney trouble, arthritis and gastric disorders. A hospital has been built there and it is planned to put up a sanatorium.

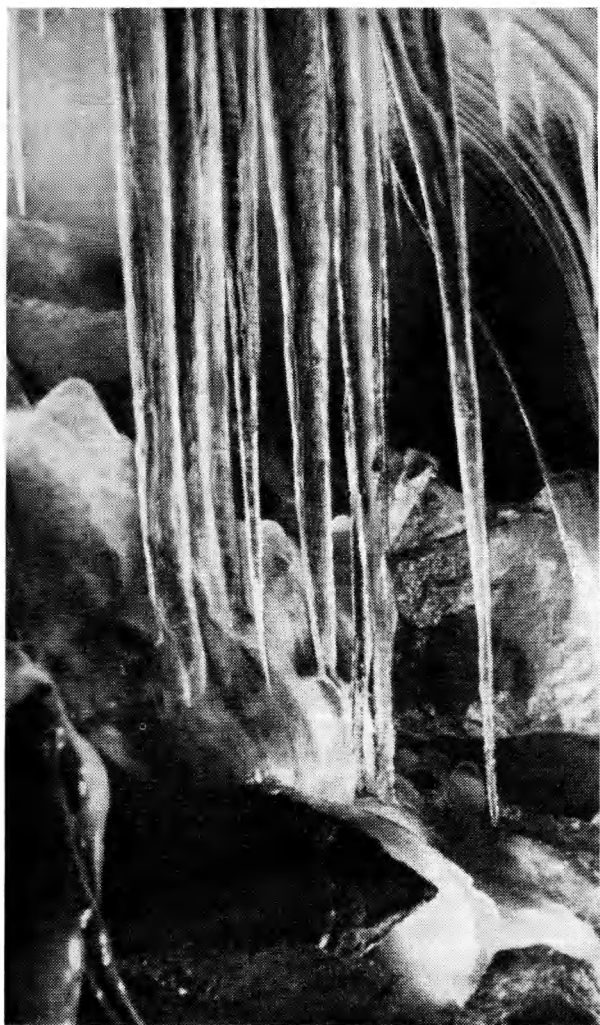
There are springs whose qualities have not yet been studied to the full. But with time this will be done and then they will be able to compete with the world famous springs in Yessentuki in the Caucasus and Karlovy Vary in Czechoslovakia.

In the vicinity of the town of Cherdyn there is a sulphur spring called Kotch, which smells of rotten eggs a kilometre away. The water accumulates in a lake which does not freeze in winter. The interesting thing about it is that it changes colour depending on the weather. On a sunny day it has a greenish hue, resembling the colour of the sea, but it heralds rain by acquiring a milkish tinge, thus helping the local people to forecast the weather.

Subterranean Castles

And so slowly, very slowly running water hollows out caves or karst voids in the earth. Some are hardly perceptible furrows or cracks similar to those made by foxes or badgers and others are wide, very long tunnels with huge halls.

Very often caves occur in the vicinity of rivers. They are flooded by spring waters which accelerate the erosion and destruction of the bowels of the earth. A case in point is the Kapova Cave. The Be-



The Kungur Ice Cave



The Sylva near Kungur

laya floods this underground castle and erodes its ceiling and walls turning them into stone lacework.

Water also creates the fantastic forest of stalactites and stalagmites. Seeping through the earth's surface raindrops dissolve the limestone containing a cave. Drops form on the ceiling and then fall; the water evaporates but the lime remains. Gradually a stalactite grows on the ceiling and a broad cone-shaped column, a stalagmite, appears on the floor directly under it. Often, if the temperature in the cave is below zero, such excrescences are also formed of ice.

Situated near the town of Kungur the Kungur Cave, the most famous in the Urals, is justifiably called an ice cave. It has grottos completely covered

with snow crystals sparkling like diamonds with all the colours of the rainbow; suspended from the ceiling by a crystal chord are extraordinarily beautiful ice flowers reminiscent of the daisy.

The descent to the cave lies at the foot of Mount Ledenaya (Mount Icy) on the bank of the Sylva. When I was a boy I just could not understand why the mount was called Icy until I saw the cave myself. It left me spellbound. After that I used to explore it each year either with my playmates or with school excursions until the time when I left to study in another town. Towards the close of winter, when the temperature in the grottos falls by several degrees, the cave shines in all its magnificence like a fairy-tale castle.

The diamond-decked Polyarny (Arctic) Grotto is wondrously charming. Then comes the depressingly dark Dante Grotto. The smallest grotto has been named Sklep (Vault). There are numerous other grottos, among them Morskoye Dno (Sea Bottom), Meteorny, Skulpturny, Korallovy, Efirny and Mokraya Kochka (Wet Tussock), and each strikes one by the unique and intricate architecture of its walls and arches which seem to have been fashioned by a giant hand.

It is hard to believe that water is the master-craftsman.

Surveying the future site of the Kama Hydropower Station near Perm, geologists had to do some drilling in the Kungur Cave. At a depth of 49 metres the drill entered a void. Evidently, there was another unexplored cave which could well prove to be much more interesting.

I heard from old-timers that a dog which had been accidentally left behind in the Kungur Cave appeared several days later looking emaciated and miserable some thirty kilometres from Kungur at a place called

Berezovka where there are numerous outlets from underground voids. It is believed that some of them are connected with the Kungur Cave. And should that prove to be correct it means that the cave extends for tens of kilometres.

It has long been noticed that the level of the two lakes in the Kungur Cave depends on the level of the Sylva River. This shows that they are connected with it and consequently one can only imagine the true size of the cave.

The Kungur Cave attracts large numbers of visitors and their flow has greatly increased in Soviet times. Today not only young people from Kungur come to see it but thousands of tourists from all parts of the country and abroad make a point of exploring this wonder of the Urals.

Before the war a tourist camp was built at the foot of Mount Ledenaya, near the entrance to the cave, and later, after the war, the underground castle itself was reconstructed considerably. Cluttered passages were cleared and widened, steps were built to facilitate ascents and descents, congelations of ice were removed and supporting walls were erected where necessary. A stone barrier was put up around the big lake in the Titanichesky Grotto and another fenced off a part of the Dante Grotto whose bent-in and cracked canopy was liable to collapse.

Then electric lighting was installed and with time wires were extended to the large lake where excursions usually ended. This has all been done for the sake of convenience, but I am inclined to think that these facilities tend to detract from the cave's wild and enticing loveliness.

Having once seen the cave it is impossible to forget the so-called organ pipes—vertical voids resembling the interior of a bell-tower. The lower opening of one such pipe gaping in the ceiling of the grotto is

clearly visible in the light of torches, while the upper end is lost in the darkness. The impression is that these pipes have been made by skilled craftsmen and not by flowing water.

M. Khlebnikov, a student of local lore who did much to make the cave famous, told me that one such organ pipe in the Druzhba Narodov (Friendship of Peoples) Grotto grew larger from year to year as it approached the surface. He predicted that it would not be long before a through passage would appear.

The bowels became exposed and a rock appeared. One might think that the earth had split to provide it with an outlet. Actually, however, due to the erosive stream work a part of the rock layer subsides. It is not that a rock has grown but rather the surrounding relief has sunk. That is all there is to the mystery of the rock outcrops.

It was a karst void that caused the sudden disappearance of the lake and left us gaping on its banks, just as another karst void swallowed the unfortunate Sivko.

In the past the inhabitants of Kungur loved to picnic and hold outdoor festivities on the banks of Lake Krotovskoye situated in a pine grove close to the town's railway station. This lake, too, appeared in a karst void.

Not for a minute does water, the eternal wanderer in eternal night, stop its destructive work of eroding rock layers which eventually collapse under their own weight into underground voids. In due course we shall visit the Severouralsk bauxite mines and see for ourselves the harm that water sometimes causes the miners and the struggle that every now and then breaks out between water and man.

There are numerous underground rivers in the Urals. But perhaps the most remarkable is the Sim

in the Southern Urals. In a small stream it emerges from the rocks at the foot of Mount Essyum. Rapidly gathering strength it rushes over its rocky bed beating itself into a foam and then abruptly disappears. A kilometre away it emerges to the surface once again and flows tranquilly without any more attempts to hide underground. People call such rivers "lost".

Another "lost" river is the Shulganovka which had hollowed out the Kapova Cave. Several kilometres away from the cave's entrance it vanishes into the ground and appears from under a cliff near the entrance.

What the Caves Tell

Since ancient times people have taken an interest in caves and have even created a special branch of knowledge called speleology which is in fact a systematic study or exploration of caves. Studying caves people obtain a better knowledge of the structure of the earth's crust. It should also be borne in mind that there was a time when people lived in caves either temporarily or permanently and it is extremely interesting to study such cave dwellings.

According to local lore many caves in the Urals, especially along the Chusovaya and its tributaries, are associated with Yermak.

Yermak, the "conqueror of Siberia" began his march from Orel-Gorodok on the Kama (former patrimony of the millionaire manufacturers, the Stroganovs). And the road he and his men covered can be traced by the names given to villages, to the sites of old towns, to streams, cliffs and caves.

There is a cliff on the Chusovaya named Yermak with a cave overlooking the water in its steep side. Legend has it that Yermak wintered there. But this



Yermak Cliff on the Chusovaya

can hardly be true for the cave is too small to have accommodated Yermak and his men.

Caves enable one to delve deep into the hoary past. Once in Kizel, Perm Region, miners blasted a coal vein. The explosion made a hole in the ceiling of an unknown cave. Its floor was strewn with bones and skulls of large animals. They proved to be the remains of cave bears and other wild animals which inhabited the Urals some forty or fifty thousand years ago.

Some discoveries cause veritable revolutions in science. One such discovery was made in the Urals in January 1959 in the Kapova Cave, which so many people have visited and explored. The lucky person who made it was Candidate of Biological Sciences Alexander Ryumin, Senior Research Worker at the Burzyansky Preserve in Bashkiria.

A Subterranean Fine Arts Museum

In different places and at various times professional and amateur archaeologists discovered pictographs and paintings of extinct animals and less frequently images of man on the walls of caves. Sometimes they found bas-reliefs and skilfully made clay statuettes.

The Kapova Cave was discovered some two hundred years ago but no one had ever thoroughly explored it. And so Ryumin and his friends decided to see if there were any paintings on its walls.

After a fourteen-hour search they grew cold and hungry and their excitement gave way to fatigue and irritation. No, that was not what they had come for. Suddenly. . . .

"Suddenly," Ryumin told me later, "we saw a fox's head on a smooth portion of a wall. Yes, a real fox's head drawn by man. We moved away the torches and then brought them close again. The head had disappeared. Was it our imagination? Feverishly we began to search the walls and found another magnificent painting—a wolf's head. A bit to the left and below was a bear's head. . . ."

There were paintings galore.

"We saw a giant wild cat, its jaws flung wide-open, its eyes gleaming and a long knife-like fang all set to strike at an unfortunate victim. What was it? A tiger, or perhaps a leopard? It resembled a sabre-toothed tiger. But it has long been extinct. . . . And there was a lioness, too. Another painting depicted an aurochs or a bison, its horns lowered preparing to attack. So realistic was the painting that we involuntarily wanted to move aside to get out of its way. Yet another was the profile of some sabre-toothed beast."

It was clear that the drawings were made at three different periods separated by tens of thousands of

years. Some of the drawings were contours made in yellow-red ocher favoured by pre-historic artists; others were engraved in the stone by some sharp stone tool. The third, multicoloured and in relief, were the most perfect. Some drawings were made on top of others. For thousands of years generations of unknown artists worked under these sombre vaults putting all their skill and inspiration into these paintings and stone engravings.

But have antelopes, lions, elephants and leopards, these dwellers of tropical regions, ever lived in the Urals?

Evidently they have. Man saw them, for otherwise how could he have painted them? It follows therefore that the climate of the Southern Urals was different then.

Some of the oldest cave paintings found in France were made approximately 40,000 years ago, that is, in the Aurignacian period. And the oldest paintings found in the Kapova Cave were also made in this period.

But what applies to West Europe is not applicable to the Urals where, according to Ryumin and other scientists, the chronology of the epochs goes much farther into the hoary past. The "Urals Aurignacian period" dates back not 40,000 years but 100-120 thousand and even 150 thousand years.

Ryumin's report was a bombshell at the Institute of Archaeology of the USSR Academy of Sciences. His discovery was the first of its kind in the Urals.

It was a sensation and the newspapers carried huge headlines: "The Riddle of Kapova Cave", "Secrets of the Subterranean World" and "Face to Face with the Millenniums".

Whenever the new is achieved in science much is viewed with doubt. Because of bad light not all the

photographs of the paintings were clear enough. Neither were all the copies of the photographs made in ink or paints Ryumin had submitted to the Institute sufficiently convincing. Many of the drawings and engravings in the cave were covered by a film of glass-like smalt—the result of the activity of the cave dew. This only further proved their great age but at the same time made them unclear and dim.

A thorough check was necessary and a group of sportsmen of the Moscow Tourist Club headed by Otto Bader, Senior Research Worker of the Institute of Archaeology, visited the cave in October 1960.

They spent three days in the cave and their first results were most discouraging. And then.... In a word, they spotted the traces of the paint mentioned by Ryumin. It was hard finding them in the poor light, but they were able to corroborate Ryumin's discovery.

A year later another expedition, this time excellently equipped, explored the Kapova Cave. Like the first one it was headed by Otto Bader. With the help of powerful lamps making it possible to detect the smallest dot and the faintest line Bader conclusively proved that Ryumin had not erred although in some instances he had been tempted to see what actually did not exist.

I am inclined to believe that the exploration of the Kapova Cave is only the beginning. Speleologists have their choice of numerous Urals caves which are waiting to be explored such as the Serga caves in the valley of the Serga near the Bazhukovo railway station, the splendid Divya Cave in the upper reaches of the Kama near the ancient Urals settlement of Nyroba.

What amazing discoveries can probably be made in the caves on the shores of the newly-formed Ka-

ma Sea: the Kulikovskaya warm and the Kulikovskaya ice caves and the Garmonovskaya Cave. Since the level of the Kama here has risen to a very considerable height after the completion of the Kama Hydroelectric Station and the formation of the Kama Sea, the only way of reaching the Kulikovskaya Cave is by boat through a huge vaulted arch.

Would it not be exciting, for instance, to probe the secrets of Lake Svetloye near the village of Vsevolodo-Blagodatskoye in the north of Sverdlovsk Region. Strange things happen there at the height of summer. While all other lakes dry up because of the heat and lack of rain, the level of Lake Svetloye rises by one and a half to two metres.

Geologists assert that the river Shegultan which flows in the vicinity is connected with the lake by an underground channel passing through karst voids and sinks. But this has to be proved.

Then there is the Svetlaya Cave also situated in those parts. It is called "Corner of the Antarctica". Underground icefalls never thaw in it. The cave is wrapped in absolute silence occasionally broken by the crystal ring of a falling icicle shattering into a thousand fragments.

The Skaz Cave in the vicinity of Nyazepetrovsk is also worth exploring. It is almost completely filled with water with only a thin sheet of transparent ice at the mouth. Here speleologists have to be skin divers too, for the only passages leading from one grotto to another are underground water-filled tunnels.

People say that the Smolinskaya Cave near Kamensk-Uralsky was once a monastery. There are remains of brickwork and eight-pointed crosses engraved on the walls. And the names of the grottos speak for themselves: "Altar", "Grand Cell", "Road to Hades" and so forth.

At the railway station in Sverdlovsk one is liable to meet young athletic-looking people with embroidered letters "SGS" enclosed in white rhombuses on their sleeves. SGS stands for the Sverdlovsk Group of Speleologists. Established in the sixties this group has in a short space of time explored underground labyrinths in the basin of the Serga, the little-studied Druzhba Cave and many others.

THE SECOND TRIP

READING A STONE CHRONICLE

How Stones Shoot

Late one autumn I met a friend of mine, a topographer who had just returned from a long trip. At the close of summer he joined a prospecting party in the Southern Urals where the spurs of the Ural Mountains meet the boundless steppe.

Nightfall found the party far from human habitation in a remote area not less than 90 kilometres from Orsk, the nearest town.

The sweltering day gave way to a fearfully cold night. Tightly wrapped in felt blankets people huddled close to the fire roasting one side until it hurt while the other became numb with cold.

Their camp was on a rocky platform rising over a craggy range of hills extending to the Ural River. It was a wild and forbidding place. Gently sloping ridges crowded one another assuming the most fantastic forms in the cold moonlight. Below, in the sombre shadows of the cliffs, the Ural splashed faintly.

The cold increased, penetrating to the marrow. It was time to get some sleep. Suddenly there was a strange creaking sound, as though far in the steppe a giant hand was bending a tree which groaned pitiously but would not break.

Some thought it was the cry of a night bird, others said that it was the earth, cooling after a hot day.

Further discourse was cut short by a deafening explosion, as though someone had fired a cannon close by. The cliff heaved perceptibly and began to tremble. Frightened, the prospectors gazed around trying to understand what had happened, but silence had already descended.

No one could sleep. When the day broke there was no further need to search for an explanation.

A fresh wide fissure girdled the cliff. A part of it had separated and slid down several centimetres.

"If the blow was a trifle stronger the platform would have hurtled down taking us along."

Why did the cliff crack? For the same reason that a hot glass cracks when cold water is poured into it.

Heated by the sun's rays the cliff expanded, while in the cold of the night it began to contract. The uneven contraction caused it to crack as though it had been blasted.

The "shooting stones" my friend told me about interested a lot of people. Some, it is true, were sceptical that the sound was actually as loud as the boom of a cannon. Others, on the contrary, were not in the least doubtful.

"And why shouldn't there be a loud explosion?" said a leading instructor at the Mining Institute. "It was the first time someone had witnessed this phenomenon, and I'm fully inclined to believe that this, I should say, lightning destruction of a huge compact mass, could easily be accompanied by a loud sound."

I had the same opinion, but it was not the sound that interested me most. I was slightly envious of my friend who had accidentally witnessed what had so often occupied my thoughts during my trips in the Urals: that which caused the destruction of mountains.

Called physical weathering, this destruction goes on unceasingly. Hot summers, freezing winters, warm

days and cold nights, not to mention water, are all enemies of the mighty mountains. Waging an interminable battle with the immobile rocks they invariably get the upper hand, slowly, very slowly, eroding and cracking them. This process will continue as long as there are mountains, water, air and life on our planet.

The Pine and the Chipmunk

Animals and plants are just as active as water and air in destroying rock formations. I frequently witnessed this on the craggy slopes of the Ural Mountains.

... The three of us, ichthyologist Nikolai Nadeyinsky, an inveterate mountain climber, his younger brother Shura, who was with my prospecting party, and I went to the Arakul for a few days of angling and roaming along the arboreous mountain slopes. It was raspberry time and the place was a paradise for those who had a palate for these juicy berries.

Arakul is undoubtedly one of the loveliest spots in the Urals. Imagine a lake as round as a soup bowl: one bank is overgrown with reeds, the other is a steep slope covered with mixed woods of pine, birch, mountain ash and alder, and above billowy white clouds floating across a bright blue sky. Arakul stands for swimming and strolling in the pinewoods, picking mushrooms and pike fishing, sound sleep and a feeling of youthful vigour, health and strength. I strongly recommend the place to all who prefer holidaying outdoors.

The first thing we did upon arriving was to climb to the rocky mountain top.

Ascending a steep path we continued to move along the cliffs. And the deeper we penetrated this kingdom of rocks the more fantastic their forms became. There, perched on a narrow ledge was ... a

hen. The silhouette of the stone was so much like a dozing brood-hen that the name implied itself. Another rock resembled a camel. We could clearly see its eyes, mouth and pendulous lips. And what could this be? Devil's Finger to be sure: an erect column-shaped rock pointing towards the sky. Twice as high as the pines, it narrowed towards the top and was crowned with a tent-like hollow rock perched on five "legs". We climbed inside and bending low so as not to hit the ceiling peeked into the chasm, a frightening experience which made us catch our breath. Frightening, and yet interesting and exciting.

Thousand-year-old sculptures chiselled by water and the winds.

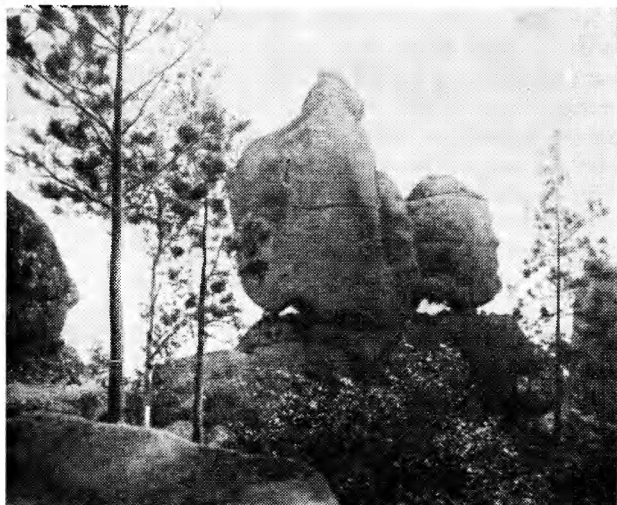
Heavy drops began to drum on the rocks. Crawling over a neighbouring ridge, a black cloud quickly obscured the sky.

Unfortunately, we had already descended from the Devil's Finger. There under a natural roof we could have remained dry. But now we had to search for shelter. We found it soon enough: a deep recess in the cliff.

A clap of thunder rolled across the mountains. The wind began to howl. A terrific downpour descended from the sky. It grew dark and a blanket of rain blotted out the mountains. Rapidly narrowing, our shelter got lost somewhere in the darkness. We forced our way as deep as possible into the crevice and sat there uncomfortably crouched, but happy to be out of range of the rain and the wind.

A terrific roar shook us out of our sense of security. The roof of our shelter trembled and for a few moments the entrance was blocked by a black mass of rocks which gathering momentum vanished down the slope uprooting trees and bushes.

A landslide. What if the roof caved in? The thought seemed to petrify us. Luckily it did not hap-

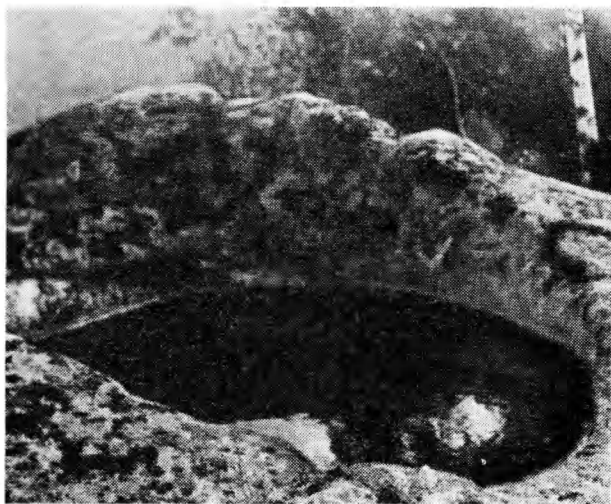


Hen Cliff on the Arakul Monadnock

pen. But we were in for another unpleasant experience. A hissing waterfall suddenly burst into our shelter and flooded it. Accumulating somewhere above us a pool of rainwater found a duct which led into the crevice.

Drenched to the skin we waited for the rain to end. Fortunately thunderstorms do not last long in the mountains. The cloud rolled away almost as swiftly as it appeared and the sun peeped out.

Our spirits soared, and promptly forgetting our sodden clothes and the water that squelched in our boots we clambered up to see what had happened. Almost immediately we noticed a fresh fracture in the cliff. Previously there was a huge granite block here: now it had split. A part of it had broken off. The other had remained in place and precariously



A stone bowl on the Arakul Monadnock

perched on it, clinging only by the tips of its roots was a solitary pine-tree.

"Look at this," Nadeyinsky pointed to its white roots.

It was clear that they had only just become exposed as a result of the landslide, or rather, it was the tree that had caused the landslide. Growing from a fissure, its strong, knotty roots kept widening the crack as they forced their way deeper and deeper into the rock. The pine split the cliff as an axe in the hands of a woodcutter splits a log. And the rock gave way. The crack sealed its doom and the sudden storm completed the work of destruction.

Innumerable pines covered the slopes of the ridge. This was typical of the Urals. Young, slender pines clinging to the cliffs insinuate their roots into tiny

at times imperceptible cracks. And each tree was a deadly threat to the rocks on which it grew and to which it clung.

Making use of the uneven surface and the bushes, our boots slipping on stones, we climbed to a height where not a blade of grass was to be seen. As we stood thinking that it was the sun and the wind that had destroyed all vegetation, we heard a whistling sound coming from somewhere below. Looking around we saw nothing but rough granite. The whistling continued. I pressed my ear to the rock. As I thought the sound came from the inside.

Failing to spot the mysterious whistler we began to descend when a graceful little animal as supple as a willow twig with dark vertical stripes on its yellowish coat darted from under our feet.

"A chipmunk," Shura yelled. "He's the whistler."

Shura and I dashed off in pursuit. But the agile little animal easily slipped away turning every now and then to gaze at us with its beady black eyes. With a mocking flick of a bushy tail and a last glance at its pursuers it gracefully lifted its body in a jump and disappeared among the rocks.

Immediately we heard a merry, triumphant whistling which gradually became fainter and fainter and then vanished.

Only now it occurred to us that we had heard a similar whistling a minute before the downpour started, but at the time had paid no attention to it. A chipmunk heralds rain by whistling "burun-burun" and therefore in Russia it is called *burunduk*.

There was no doubt that the animal lived in the heart of the mountain, and that meant that if it found a way in, water had also penetrated unhindered to continue its everlasting work of eroding rock. One might think that animals, plants, the wind and the rain have all conspired to shatter the mountains,

Granite Bowls

"Now I shall take you to drink." Nadeyinsky's official tone did not match the mischievous twinkle in his eyes. With these words he began to clamber still higher up. "Hurry up, you aren't scared, are you?" he smiled, noticing our surprise. All of us were thirsty for a long time already. Large beads of sweat rolled down Shura's lean sunburnt face. His clammy shirt stuck to his back and he panted heavily licking his dry lips. Nadeyinsky was in no better state, although it seemed that he was thoroughly enjoying himself. I was feeling pretty miserable too.

Reaching a bald, gently sloping height we stopped in amazement. It was the most elevated point of the ridge and the site of one of the greatest curiosities of Arakul.

We saw a round cavity in the flat surface of the granite. In fact it was absolutely round, so much so that one got the impression that a pair of compasses had been used in making it. About two metres in diameter and 50 centimetres deep it was filled almost to the brim with water which was so clear that at first we failed to notice it.

Shura and I gaped.

Undoubtedly it contained rainwater. But why did it not evaporate? Exposed to the scorching sun the rocks were so hot that it hurt to touch them. I could think of no plausible explanation except that the frequent downpours in the mountain kept the granite bowl filled.

What completely defied explanation, however, was how such a perfectly round cavity could have appeared in the hard rock. Perhaps it was the work of man and not nature. Yet, judging by everything, such an explanation, unlike the bowl, held no water.

Our amazement mounted when we discovered a

similar cavity on a neighbouring height. It was smaller and instead of water was filled with moss.

Stepping on the green pillow I found that it was as resilient as a well-upholstered armchair and straightened out the moment I lifted my foot.

The granite bowls seemed to be an inexplicable wonder.

How did they appear, and when?

Shortly afterwards I saw similar granite bowls only in another part of the Urals. . . .

. . . Dear friends of mine, Shura and Nikolai. Writing about the granite bowls I keep thinking of you. If mountains are not eternal, then what can be said about people? Shura was killed at Stalingrad. Nikolai had also departed this life. But I shall never forget them. It was thanks to them that I came to know the Urals.

Bowls Again

The train whistled, slowed down and with a final jerk pulled up at the platform.

"Isset Station," the conductor announced.

Isset lies just over 20 kilometres from Sverdlovsk on the way to Nizhny Tagil. In the summer, week-end excursion trains bring thousands of holidayers from Sverdlovsk who have made the Isset and Tavatui lakes, the Chernaya (Black) River (there are numerous Black rivers in the Urals) and the Flyus Siding their favourite haunt.

Shouldering our rucksacks we set out at a brisk pace along a path leading through a wood adjoining the railway. Descending to a stretch of marshland we crossed it over a makeshift causeway whose shaking boards tended to twist our ankles and echoed under our heels. A sharp turn to the left and we were on solid ground in a dense forest.

The path ran down to a boggy gully, then climbed a steep slope to emerge at a stream half-hidden by windfallen trees and branches. Further down the path plunged into a thicket through which we struggled arms raised to protect our faces.

Reaching the fringe of the windfall we found ourselves on a slope sparsely dotted with hoary pines. Here and there black rocks jutted out from among last year's yellow grass and dry pine needles. Forming an ascending chain, they seemed to indicate the way for the hikers.

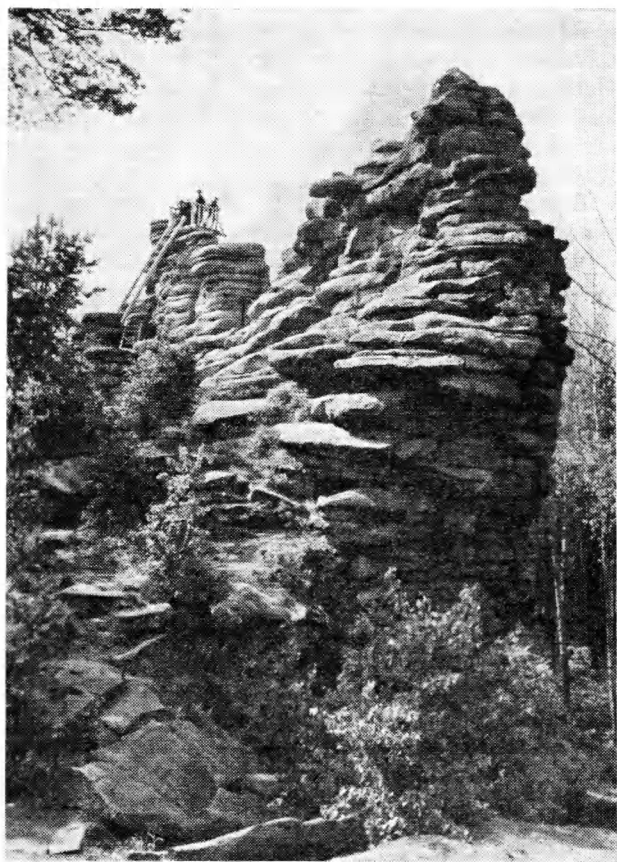
But what could that be there, among the pines?

Was it a figment of our imagination or did we actually glimpse the remains of some giant creature that had gone to sleep on top of the hill and had turned to stone to become part of the landscape. It resembled a skeleton of a dinosaur or a stegosaur or some other extinct large reptile that inhabited our planet millions of years ago. Their heads on long necks rose above the highest trees. And the head of this one, too, was visible above the woods.... For millenniums it has been lying there with its jutting vertebrae and ribs while trees fell and grew up again incalculable number of times. Perhaps it was the dragon from Russian fairy-tales, the bogey with which a grandmother would frighten a disobedient child. How did it come to rest here?

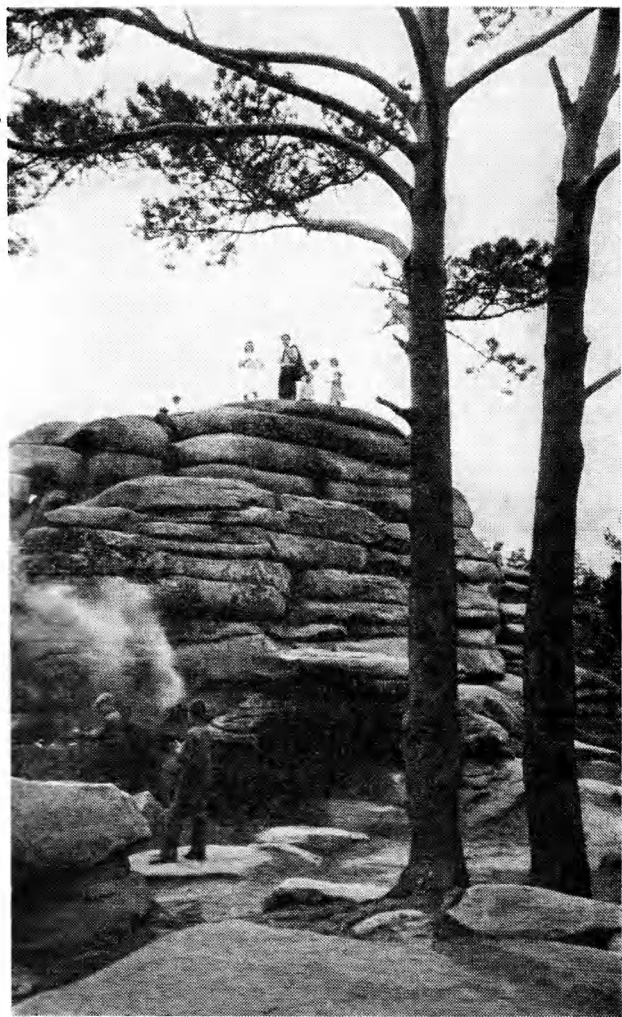
Emerging from the thin woods we saw it in all its splendour.

At close range it looked more like the ruins of a stone structure built without mortar as was customary in ancient times. Round and flat, many-ton granite discs, piled one on top of the other like stacks of plates, rose in tiers over the crowns of the firs. Who had placed them on top of each other? One could not get away from the impression that it was a man-made

structure. But what need was there to build it in such a remote spot? The people justifiably called it Chertovo Gorodishche (Devil's Town).



A cliff of the Chertovo Gorodishche



The Shartash Kamenniye Palatki

Half-way to the top we reached a sloping platform where a traveller could light a fire and bivouac. This was the southern side of the Gorodishche and the sun had heated the stones to such an extent that it hurt to touch them.

Searching for a place to hide from the sun's rays I went over to the northern side and the view that opened before me really took my breath away. What I saw could only be described as a feudal castle complete with a corner tower, merlons and embrasures. . . . Now how on earth could all this have appeared without the assistance of a mason? Discs of grey Ural granite were arranged with the regularity of brickwork, and I involuntarily compared it with a kremlin that required renovation, as though one could renovate a work of nature.

It only just struck me how ancient and time-worn the place was, though it still looked as formidable and unassailable as a medieval fortress. Numerous fissures ran from the topmost tier to the foundation splitting the stonework into huge segments. The eastern tower was inclined and looked as though it was about to topple. The vertical wall was also half-crumbled and in places had leaned over touching the tree-tops. Many granite discs had fallen out of it and lay at its foot, overgrown with grass and moss.

Ascending the stepped southern slope I reached a wooden observation platform built at the highest point of the Gorodishche. What a magnificent view. All around were woods with winding rivers and shimmering blue lakes; far away in the purple haze I saw the white and red cubes of Sverdlovsk houses and the factory smoke slowly rising into the sky. Overwhelmed by a sense of infinitude I felt myself dissolving in the picture and becoming a part of it.

Wanting to stand on bare granite I stepped down from the platform. It was not exactly a safe thing to do, for the disc on which I put my foot rocked slightly and emitted a dull thud. The discs were loose here and a bright spot indicated where one of them had recently rested and now was lying on the ground below. Nearby I saw something which made me think of Arakul.

It was a bowl, just as round as those in Arakul, but only smaller and without water or moss.

My friend who had made the ascent with me exclaimed:

"I've got it."

"Got what?"

"I mean it just occurred to me that I've seen a similar bowl at Kamenniye Palatki."

He was absolutely right. Kamenniye Palatki (Stone Tents) are cliffs in a forest park of the same name on the outskirts of Sverdlovsk. Consisting of the same discs of rough Ural granite piled up in tiers faintly resembling Kirghiz tents these cliffs, however, were far less spectacular than the Chertovo Gorodishche. One of them had a cavity resembling a bowl. Though small and flattish it was undoubtedly from the Arakul set.

Archaeological excavations at the foot of Kamenniye Palatki disclosed that the place had been the site of a pre-historic man's encampment. So perhaps the bowl was made by man after all? The ancients could have used it for grounding grain or lighting signal fires.

But then why was it necessary for them to grind grain on a high platform exposed to the winds? Or why did they have to light signal fires in a specially made cavity in the cliff?

Evidently there must be another explanation of the origin of these bowls.

Sem Bratyev

Some ten kilometres from the mining township of Verkh-Neivinsky there is a group of cliffs known as Sem Bratyev (Seven Brothers). To reach them it is necessary to follow a footpath which runs across marshes spanned by rickety bridges made of thin poles and cuts through thick woods where not a rock is to be seen as though all of them have hidden beneath the tussocks.

But on top of the Sem Bratyev Hill rocks protrude like awls, rising in a broken comb above the trees. Sem Bratyev is a craggy massif made up of a row of six upright cliffs, while the seventh stands all alone at a distance.

Still further away, among densely growing pines, darkens another cliff called Sestra (Sister).

It was here, at the foot of Sem Bratyev, that the Verkh-Neivinsky workers held their secret meetings during the grim years of tsarism. Speeches were made and revolutionary brochures and leaflets were read. Preserved to this day are the words: "Long live the social revolution" inscribed on one of the granite rocks in 1912, that is, five years before the October Revolution.

Nearby is a common grave, the last resting place of the workers shot by the whiteguards in 1918.

The structure of the cliffs is the same as that of the Chertovo Gorodishche and the same panorama unfolds from the summit. They say that on a clear day it is possible to see Sverdlovsk which is 70 kilometres away. But I was unlucky, I ascended the Sem Bratyev on several occasions and each time a thick haze limited visibility. It is worth while seeing Sem Bratyev where nature displayed still greater ingenuity. Rocks, balancing one on top of the other like circus performers, form irregular columns, which have



Stairs lead up the highest of the Sem Bratyeve Cliffs

miraculously retained their upright position despite tempests and storms. The flanking "brothers" are much lower than those in the middle. The central "brother" dominates the group and on its summit there is a bowl.

Sem Bratyev, Chertovo Gorodishche, Kamenniye Palatki at Lake Shartash near Sverdlovsk, the Arakul ridge form a chain of mountains and elevations extending from north to south. Each summit is topped by a cap formed of flat circular rocks, and each cap has a round cavity.

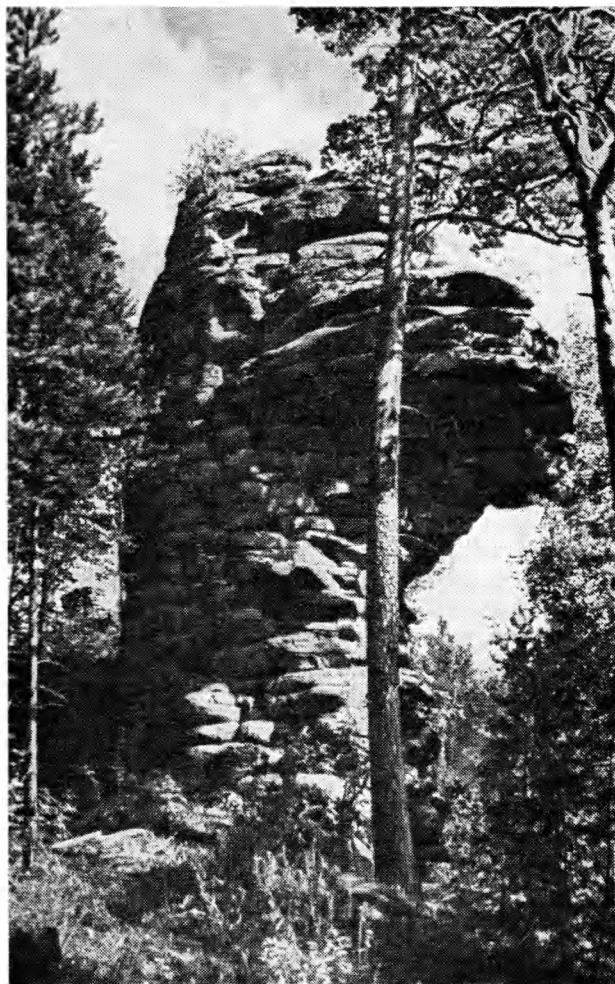
There is a definite regularity. But how did it all originate? Why are the stones flat? How were the cavities formed? What unknown builder moved from north to south, gathered rocks, stacked them up and having flattened them bored these accurate cavities?

The Mystery: Still Unravelling

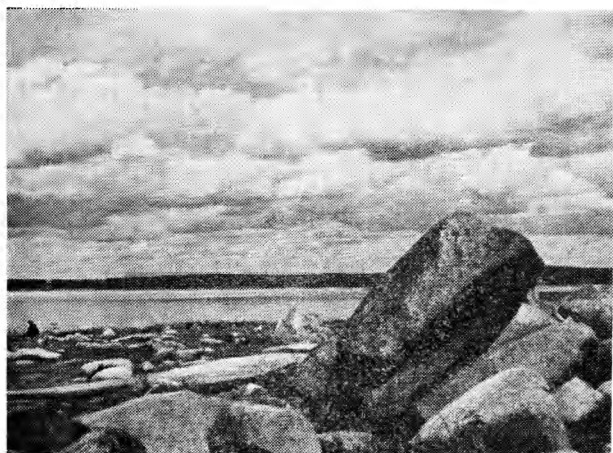
Thousands of holidayers from Sverdlovsk spend Sundays on the sloping banks of Lake Shartash which laps gently on the city's eastern outskirts. Characteristic of the Shartash landscape are huge boulders, some lying far apart from each other, some in picturesque heaps. They are also scattered on the bottom of the lake and at times appear above the surface like the backs of whales. On a warm day it is pleasant to stretch out on their smooth surface and bask in the sun.

It was among these boulders that I again saw what had so often amazed me.

A bowl. . . . A very small one and not deep at all, but it contained something which immediately caught my eye: a perfectly round stone, very much like a billiard ball. Both the stone and the bowl were of granite and were such a perfect match that I could



Mount Sestra



Lake Shartash

not help thinking of a direct connection between them, and that could only be that they had been made by one and the same master-craftsman.

Most probably that craftsman was weathering, the ordinary frost weathering of granite: remaining on the rock's surface the water froze causing microscopic cracks which led to the gradual disintegration of the monolith and the formation of the round cavity.

These bowls were a tiny but striking element in the general picture of the gradual disintegration of the Ural Mountains resulting from an aggregate of factors: glaciers, frosts, the sun, winds, water and air, and plant and animal life. Under their impact lofty snow-crested heights and ridges turned into wooded slopes with time-croded summits.

Such are the Ural Mountains. Only in the northern and southern fringes of the range are there isolat-

ed peaks of over a thousand metres. Covered by rock debris with cliffs weathered into fantastic shapes they tower over the surrounding forest expanses. But just a peek into the hoary past is all that is necessary to see that all this is merely the remains of former grandeur.

Stone Giants

In the thirties a geological field party was sent to prospect for gold in the Northern Urals. The geologists took numerous bed samples in an extensive region where the upper reaches of the Pechora, Sosva, Lozva and Shchugora rivers flow close to each other.

The expedition also had to explore the Man-Pupy-Nyor or Bolvano-Iz range, the subject of numerous legends.

A difficult road lay ahead. First one had to travel on horseback or by car from Ivdel to a place called Ust-Manya, the rest of the way had to be made on foot, on rafts along the Ilych and Pechora rivers and through marshes.

Early one morning when the surrounding hills were still floating in a haze faintly streaked by the sun's rays, the group of prospectors with guides set out on their journey leading their pack-horses by the reins. It was tough going and at times it seemed that they would have to turn back.

A forest fire had blazed here and the earth was strewn with charred tree-trunks. Patches of black burnt-out forest alternated with marshes. Reaching the foot of Mount Iout-Huri the party began the ascent. The hill's gently rounded silhouette slightly indented in the centre lent it a resemblance with a bow, hence the name Iout-Huri which in the Mansi language means "bow for shooting". About a thousand metres high, Iout-Huri is one of the loveliest spots in the Northern Urals.

Finding its way blocked by taluses the party was forced to slow down the ascent. It seemed that each stone was alive and was only waiting for someone to step on it to slip away and roll downhill threatening to overturn the offender. A single rock could precipitate a roaring avalanche.... In the Northern Urals such places are called *kurumniks* or stone rivers.

Horses stumbled and fell cutting their pasterns, but miraculously not a single one tumbled down the slopes. It was not easier for the men.

About 600 metres uphill there was a belt of stunted forest which was succeeded by a stretch of brushwood that in turn gave place to Alpine meadows. Higher up there were only mosses and lichens, including reindeer lichen, interspersed with bindweed, and of course, rocks, grey bald rocks.

Below, in the valley, where the geologists had pitched their tents, the sun was shining brightly, while on top of the hill visibility was limited to several metres by an endless train of clouds and a thick fog which covered the men's faces with minute drops and soaked their clothes.

The geologists groped their way forward guided only by the compass needle. At last they reached the highest point, a flat, barren platform covered with a thick layer of disintegrated rocks—all that remained of what had once been a massive summit towering high above the clouds.

For a moment a sudden gust of wind ripped a window in the grey fog through which as though projected on the screen of a cinema theatre there appeared a panorama of distant sun-lit mountain chains.

"There's a man there," someone exclaimed.

A solitary figure stood on a bare height some distance away. The group gazed in surprise, but the gap

in the fog closed rapidly blotting out the vision. "Hey! What brings you here?" a voice called out in broken Russian.

A Mansi hunter with a gun emerged from the fog. Exchanging greetings and discovering the group's destination the man offered to show them the road.

Could he have been the lonely figure on the height? "No," came the laconic reply.

When the group began to descend the opposite slope of the hill, the wind finally dispersed the clouds and then far away, at a distance of about 20 kilometres, they saw not one but seven human figures. Something to think about. The figures did not move. One got the impression that they had been moving in chain along the ridge, keeping at a distance from each other like mountain-climbers, but having heard something froze in their tracks. What sort of people could they be if they were clearly discernible some twenty kilometres away? At a distance of two kilometres an ordinary person looks no bigger than an ant.

With the ascent of the Man-Kvot-Nyor ridge still to be made, the geologists had no time to lose and quickened their pace. The old Mansi hunter knew each hummock and the group made good progress, thinking not so much about the gold they had set out to find, but of the silently beckoning giants.

On the third day, having covered the most difficult part of the way, they emerged at the upper reaches of the Pechora. Now only a short distance separated them from the Man-Pupy-Nyor ridge on whose top the giants were standing.

The remaining kilometres lay across luxurious mountain meadows where grasses rustled underfoot. Startled partridges with a loud flutter of wings darted from under the very feet of the travellers. One more effort, and they came within 300 metres of the

rocky plateau with the seven immobile giants on it.

Spread out in a line like an attacking chain of skirmishers towered seven Cyclopean columns, seven stone idols, as the Mansi hunter aptly called them. Rising to a height of thirty metres the biggest was as high as a ten-storey building. Narrow at the base it gradually broadened out and had a flat top as though it was a pear standing upside down.

Composed of quartzite, one of the hardest known rocks, these grey and cracked idols even at close range strikingly resembled petrified giants.

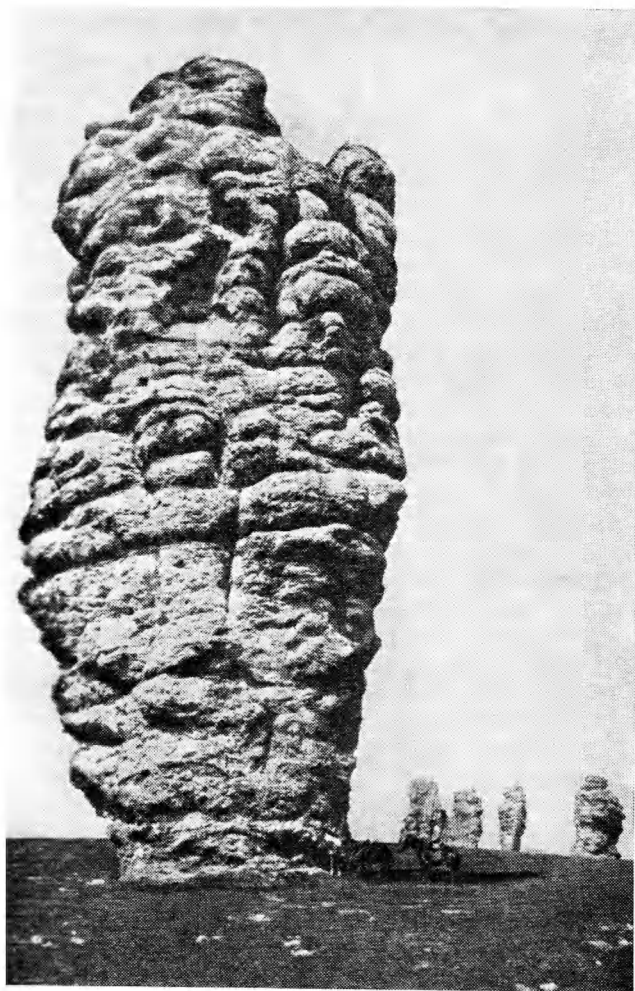
...Many generations ago, in the abysm of time when the Mansi were a mighty tribe, the Saran (Zyrian) warrior-giants went to war against them. The giants wanted to vanquish the Mansi, seize their furs, fishing and hunting implements, their sacred and ritualistic articles and other riches and take their wives and children into bondage.

At the time a great man, a very great man not in stature but in intellect, a kind wizard, the patron of the Mansi people lived on the sacred Yalping-Nyor Mountain. He came to the assistance of his people and ordered the Saran giants to turn back. But they would not hearken to his words. In great rage he cast his tambour on the ground turning the giants to stone.

So runs the legend. But what is the true origin of these stone idols?

The explanation is a simple one. Once the crest of the Man-Pupy-Nyor Mountain passed along the heads of the giants. But subjected to weathering part of the mountain turned to dust and was scattered by the winds and part of it remained in the form of separate columns.

While Man-Pupy-Nyor is called the Mountain of Stone Idols, its distant neighbour Terre-Porre-Iz is known as Stone Town. On it you will see fortress



Stone Giants

towers, ramparts, ruins of houses and straight streets—a veritable dead city.

Close your eyes and listen, and you will hear the hubbub and the noise of a crowd, and the pattering of feet. You would almost imagine that the place had just been abandoned.

Weathered cliffs resembling the idols of Man-Puppy-Nyor or the dead city of Terre-Porre-Iz are found in other parts of the Urals.

Once chance brought me to Lake Itkul situated in the vicinity of the Kasli factory famous for its cast-iron mouldings. In this part of the Urals called the Transurals Lake Depression, there are over 150 big and small lakes of which one of the deepest is Lake Itkul.

A typical mountain lake, it lies at an altitude of approximately 300 metres above sea level.

A path running through a dense pinewood led to a high and precipitous shore. Below splashed the lake while rising from its depths directly in front of me was a solitary rock called the Shaitan or Devil Cliff. It is of the same origin as the Saransk giants, the only difference being that nature had whimmed it to stand in the centre of a body of water.

And here I thought how strange it was that all the rocks and cliffs that I had seen during my peregrinations of the Urals were so different in shape. Why did some resemble the towers of ancient kremlins, while others were flat and expressionless? Why was it that weathering had turned some mountain chains into fantastic tiers of granite discs like Chertovo Gorodishche or Sem Bratyev, and others into columns like the wondrous idols on Mount Man-Puppy-Nyor, held in such high esteem by the Mansi people? Are not all of them equally subjected to the destructive action of time?

Nature's Geological Laboratory

Once a friend of mine, a geologist, suggested that I should make a trip along the river Chusovaya. "We, hunters for stones, call the Chusovaya nature's geological laboratory. It helps us visually trace the entire history of the Ural range: its origin, senility and gradual demise. The Ural Mountains are very old, but it is only on the Chusovaya, in the very heart of the range, that one gets a full idea of their great age."

He paused and added: "A friend of mine and I will be going there in a week's time. We've decided to spend our holiday on the river. Join us, you won't regret it. Bring your camera along. You'll be able to make some splendid shots there, take my word for it. So don't refuse."

... The sun rose in the east lighting up the cloudless sky. Hastily packing, we hauled our equipment down, into the boat, making several trips up and down the hundred and three steps running from Sobachyi Ryobra (Dogs' Ribs) Cliffs to the Chusovaya and cast off to the accompaniment of farewell shouts from the director of the Kourrov Tourist Camp. Caught by the swift Chusovaya our flat-bottomed boat was carried into mid-stream where the racing current had cut a deeper bed.

The building of the tourist camp rapidly dwindled out of sight.

Suddenly our boat jerked, its bottom rasping on the pebbles. The stern swung forward and we barely missed getting swamped as it ground to a stop broadside to the pounding current which showered us with water.

We promptly jumped overboard. Relieved of our weight the boat floated off the bank enabling us to continue our journey. Such things happen very often on the Chusovaya.

We had our hands full on the frolicking river which hurled us from bank to bank. The only thing we could do was to humour its caprices and thus avoid the rapids that were all the more dangerous for our frail boat because all of them were rocky and the race was strewn with rocks where water leaped and churned as in a kettle. Approaching a rock one got the impression that some strange monster was swimming towards you. The resemblance was so striking that it took us some time to get used to it. Gradually, however, we became accustomed to the rapids and began to admire the banks.

They were lovely indeed. In places the Chusovaya flowed between jutting cliffs called fighters. Some-



The Chusovaya on a summer day

times it wound between them like a serpent, and then straightening out would hurl itself at one of these stone giants, only to dart angrily to one side and twist itself into another loop. These cliffs were fighters in the full sense of the word. For millenniums they have been withstanding the unceasing onslaught of the river and fettering its flow. Still it is water that is lord and master here. It had cut a way for itself through the mountains, pierced their heart and keeps eating away at them without respite.

There were places where the banks squeezed the river forming a narrow corridor through which it foamed and roared hurtling over the countless rapids. Here the helmsman had to have all his wits about him. Carried by the current, jumping from wave to



Kyn, one of the oldest towns on the Chusovaya

wave, the boat sped at a breath-taking pace. Considerable skill was also required to round a steep bend without crashing into one of the cliffs on the bank or getting stuck on a rock.

In shallow stretches we had to climb out and teetering in the strong current tug the boat which pranced like a spirited horse into deep water.

At last the banks widened and the cliffs receded far to the fringes of the floodplain.

The Chusovaya quietened down and flowed tranquilly between the distant banks gathering strength for another reckless race.

Day after day we sailed downstream without feeling the least bored. And how could we? We simply could not tear our eyes away from the banks and the impressions were so absorbing that we lost all track of time.

Water created a natural geological laboratory, as my geologist friend called the Chusovaya. It exposed rock masses, stratifications dating back to various periods, and most interesting geological deposits.

... We lunched at Kamen Palatka (Tent Cliff). The cliff was not very big and when seen from the river was reminiscent of the Shartash Kamenniye Palatki. Water had made a small cave in it.

From here the Chusovaya formed a bend and racing for five kilometres returned to approximately the same spot. The opposite end of the meander is dominated by Perevolochny Cliff. The isthmus between the two cliffs is not more than 60-70 metres wide. Previously, to save time, boats were hauled overland here and the name Perevolochny derives from *volok*, meaning portage.

After lunch I went to take a look at Perevolochny Cliff while the others sailed downstream.

Forming a lengthy wall along the bank the cliff amazingly resembled a medieval castle with well-

preserved cornices, arches and towers, massive colonnades, merlons and embrasures. Only mailed knights were needed to make the impression complete. The red-brick colour of the stone gave the cliff added resemblance with a castle.

The Chusovaya flows tranquilly here. Reflected upside down in its clear water was a second Perevolochny.

The foot of the cliff was greatly damaged by flood waters. Each spring the river does its best to undermine the cliff and sooner or later it will succeed in its efforts.

Waiting for the boat I picked up some rock fragments scattered on the bank. They were bits of limestone bearing the imprints of shells and spirals. Glancing around I saw the fossilised remains of the sea dwellers themselves and hastily pocketed them. All those sailing along the Chusovaya always stuff their rucksacks with these fossils, a welcome addition to any collection.

But how could one account for the presence of the remains of marine animals in the centre of the Eurasian continent? And the limestone, being a sedimentary rock, could only have originated on the bottom of an extensive basin.

These bits of limestone proved that this part of the Urals was once the bottom of a sea. There was no Chusovaya, no lovely forests and no hills; just a boundless expanse of salt water. Thick layers of sediment were gradually deposited on its bottom. Then powerful subterranean forces pushed away the sea, raised its bottom and erected high mountains.

On display in the geological museum of the Sverdlovsk Mining Institute is a chunk of limestone with a strange spiral-shaped petrification which was discovered in the vicinity of the town of Krasnoufimsk.

For a long time scientists were unable to say

exactly what it was until one of them, a prominent Ural geologist, Alexander Karpinsky, subjected a piece of the petrification to chemical analysis which showed that it was dentine, a material of which teeth are made. The strange spiral was the tooth of a prehistoric shark. And so the place where Krasnoufinsk now stands was once the bottom of a shark-infested sea.

... On the following day we sailed past the Romanov Cliff. Outwardly, but only outwardly, there is nothing special about it.

The fact of the matter is that it is made of several layers arranged in such a way that the later strata lie below the earlier ones. That is the strange thing about it. It is like an inverted crustless pie.

But what is the explanation?

The Romanov Cliff is yet another proof of the way the Ural range was formed. Waking from their slumber the stupendous dormant forces in the depths of the earth built mountains where none had existed before. And the same forces violated the original structure of the mountains. They shook and squeezed, and in places even overturned them.

... The famous Kashki rapids at the village of Kashki. We could clearly see the gradient of the river. Tossed by the waves like a ball, our boat raced past the Golubchiki Cliffs with such speed that we were unable to take a good look at them.

Several bends further downstream the river, suddenly subdued, gently flows into the deep shadow cast by Omutny (Whirlpool) Cliff, a smooth sheer wall rising directly from the water to a height of a fifteen-storey building. It is probably the most majestic cliff on the Chusovaya. Water has polished it almost to perfection. It strikes you that the Chusovaya flowed at a much higher level once and gradually

cutting deeper and deeper into the rock reached its present level.

The primeval silence is disturbed by an occasional splash which evokes a ringing echo. An uttered word is repeated a second later by someone on top of the cliff. Our one desire was to lean on the oars and listen to the wonderful, fragile silence.

Turning away from Omutny Cliff the river flows past Dyrovaty Cliff. This huge mass of rock is formed of several inclined limestone layers with a number of caves situated high above the water.

Rounding another bend we sailed past the Olyeny (Deer) Cliff. Extending for approximately half a kilometre, it is the longest cliff on the Chusovaya. Heavily weathered, its top had split up into weirdly-shaped stunted columns which, it is said, account for its name, although to my view even a person with the most vivid imagination would hardly find a resemblance between these columns and the antlers of a deer. According to another legend, and this one seems more probable, the cliff got its name because a hunted deer plunged into the river from its top.

... We reached Kyn late in the evening. But before that we sailed past Pechka (Stove) Cliff with the speed of an express train. The cliff strikingly resembles an open Russian stove.

A bit further downstream on the right bank rose the black mass of Vysoky (High) Cliff. Over a 100 metres in height it has been aptly named. In silence we sailed past this giant whose top was lost in the fog and clouds. In the Komi-Permyak language Kyn means very cold or frozen and it was indeed cold when we arrived there.

Kyn is the site of one of the oldest iron and steel factories on the Chusovaya. It remained in operation until 1911, and like the other enterprises on the river it transported its output on barges.

It was not an easy job and the river took its toll of human lives in payment for services rendered. Each cliff spelled danger, for in the spring the Chusovaya usually goes mad. People perished and so did the material values produced by Ural founders and smiths. Once a barge crashed at Vysoky Cliff at Kyn and for many years afterward sunken crates of copper were found in the river.

But the most notorious is Razboinik (Robber) Cliff where dozens of barges met their doom. It is impossible to say how many lives it took. But when we sailed past it did not look menacing at all. The Robber did his work only during the spring floods.

... It was our last night in a tent on the river bank. Tomorrow we would reach the Chusovskaya Factory and end our journey in the course of which we had covered about 350 kilometres by boat, negotiating hundreds of foaming rapids and sailing past numerous picturesque cliffs relating both the geological and the industrial history of this part of the Urals.

With the construction of hydropower stations and dams the Chusovaya will be fit for rafting and also for navigation. And then tourist traffic along it will increase immeasurably.

It was a rainy evening. We sat round the fire chatting quietly. A mist enshrouded the river. Suddenly it drifted apart and a rare view unfolded before our eyes. The hills smoked. White eddies as though smoke from invisible fires curled up from beyond the forest. Thick, milky ribbons rose slowly into the sky to form new leaking clouds. (A sight to be witnessed only in the hills!)

Slowly, in just the same way as these white eddies rose and merged into rain-laden clouds, ran the train of my thoughts in which scattered impressions and observations fused into conclusions. . . .

Have I found here, on the Chusovaya, the answers to questions that were revolving in my mind, one of my companions asked. Yes, I believe I have. Thanks to it I have turned several more pages of the wonderful book of nature.

A Stone Preserve

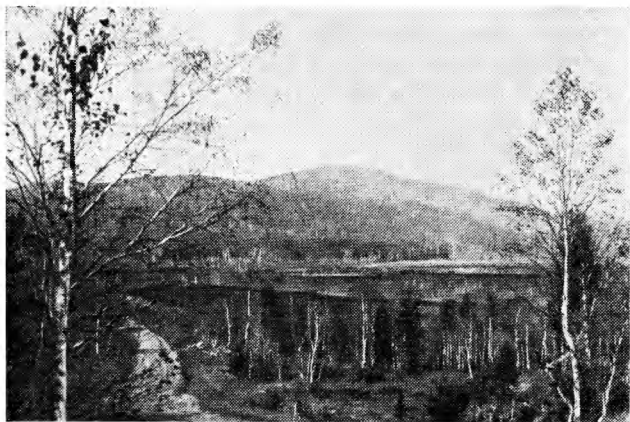
One day I was surprised to hear that there is such a thing as a stone preserve.

We know that rare animals and plants, historical and architectural monuments are protected by the state, but hearing about stones being protected was rather unusual. "What's there to protect?" the uninitiated may ask. "If they are precious stones then they should be mined. And if they are not precious, there is no need to protect them."

To all appearances a logical conclusion. And I was inclined to think the same until I paid a visit to the preserve situated in the vicinity of Miass station not far from Chelyabinsk on the railway to Zlatoust.

My first impression was one of disappointment. I saw ordinary hills, sloping and without cliffs, resembling knolls, and thought that the hills in the Southern Urals were much more beautiful.

And so when I began a tour of the Ilmeni Preserve, or Ilmeni, escorted by a member of its scientific staff, I did not in the least expect to be surprised by anything he had to show. We spent the whole day roaming in the hills until our legs ached and when evening fell it was with a sense of guilt that I recalled my first impression of the place. It was a museum, perhaps the only one of its kind in the world; a unique museum created by nature itself. Vast mineral wealth was concentrated in these sloping hills covering a relatively small area. Its material value was obvious. But its value for science was far greater.



Ilmeni Hills

Throughout the preserve there were shallow pits, some of which had remained from former excavations, while others had been dug to give a better view of the minerals to be found in Ilmeni.

This is particularly important not for the ordinary sightseers who come here out of sheer curiosity, but for specialists in mineralogy.

Each pit was interesting in itself.

I inspected the Blum Pit, named after F. F. Blum who discovered it in 1835. It is the most famous pit in Ilmeni and minerals extracted from it are on display in all major museums of the world. A number of very large topazes were discovered in it. All in all it contains 20 different minerals.

Very interesting is the Miaskite Pit. A thick seam of miaskite tonguing out to the surface has a transversal yellowish vein of graphic granite or Jew's-stone (so called because of a peculiar pattern reminiscent of the writing of the ancient Jews) glittering



Falcon Cliff in the Ilmeni Preserve

with impregnations of amazonite. Ural prospectors have called amazonite the "stone of blue hopes"—for a vein of amazonite leads to deposits of still more precious stones.

Each pit contains some new minerals and one even has as many as fifty. All told, over 200 minerals have been discovered and described in the preserve and almost each year more are discovered.

Ilmeni is mentioned in all textbooks on mineralogy and for good reason.

The celebrated scientist Academician Alexander Fersman, who poetically described the varied world of stone, called Ilmeni a "mineralogical paradise". Pavel Bazhov, the great Ural raconteur characterised it as the "treasure house of the Urals", and wrote a tale about it called *Sun Stone*. He did not invent the name. Sun stone, a bright, beautiful stone shining with a myriad of golden sparks does actually occur in the hills of Ilmen-tau.

Some 15-20 thousand visitors, among them scientists, students and people interested in geology and the country's natural environment, visit the preserve.

The first news about the extraordinary mineral wealth of Ilmeni was brought in 1770 by the world famous scientist and traveller Academician Pyotr Pallas who during a trip to the Urals visited the place and was amazed to learn how generously nature had endowed it.

The Ilmeni treasure box contains topazes, amethysts, tourmalines, garnets, stones so precious that they are weighed in carats (0.2 gramme); wolframite and molybdenite, which yield wolfram and molybdenum; graphite; corundum, used industrially as an abrasive; nephelines, jaspers, rhodonites, lazurites and agates.

In 1799 lode gold was discovered in Miass, close to Ilmeni. A quarter of a century later fantastically

rich gold placers were discovered there, and Ilmeni became known throughout the world.

But until the Revolution Ilmeni had no real master. Numerous prospectors plundered its riches. Though owned by the tsar's treasury, Ilmeni suffered no less damage from this institution than from all the individual prospectors who searched for riches at their own risk. The general rule was that if there were riches to be had then hasten to lay your hands on as much as possible. Prospectors washed sand for gold and searched for amethysts, zircons and topazes. And no one, or almost no one, paid any attention to the tremendous scientific significance of these hills.

The October Revolution put an end to all this. Soviet power was established in the country, and on May 14, 1920, the Council of Ministers issued a decree signed by Lenin proclaiming certain sections of the Ilmeni Hills near the Miass River in the Southern Urals a national mineralogical preserve designated solely for research purposes, in view of their exceptional importance for science.

Subsequently the Ilmeni Preserve was named after the founder of the Soviet state Vladimir Lenin. The monument to this great leader and man which rises at the entrance reminds one and all of his untiring concern for the preservation of nature's riches.

A major role in the establishment of the Ilmeni Preserve was played by Academician Alexander Fersman. In love with the Urals he took a keen interest in the future of the preserve and drew up the necessary documents on the basis of which the Council of People's Commissars issued the above decree.

Ilmeni is not only a storehouse of minerals. It is also a wildlife and forest preserve containing over 800 species of trees, shrubs and grasses and numerous animals and fishes. Once beavers lived here, but they were exterminated and so some of these ani-

mals were resettled from the Voronezh State Preserve. Proliferating rapidly they now inhabit all the rivers and streams in Ilmeni. Spotted, or flower deer, were brought here from the Far East and have rapidly become acclimatised. Desmans were resettled from the Oka, and valuable species of fishes, including whitefish, are being bred in the lakes.

The wildlife is protected by wardens who know every burrow and nest in the preserve. Sensing their great love, the animals have almost completely lost their fear of man.

There is something enchanting about Ilmeni.

Roe deer, gentle and timid, roam the thickets slumbering to the blithesome twittering of the birds. Water-lilies raise their yellow heads above broad leathery leaves floating next to white water-bells in the peaceful backwaters shaded by a canopy of arrowheads and cattails; and centennial birches and willows gaze demurely at their images mirrored in the still surface of the water. In the autumn the glades are covered with mushrooms.

But above all it is a preserve of stones. . . .

Our whole planet is a world of stones, a world of minerals, and there is no gainsaying it is an absorbing world.

THE THIRD TRIP

THE URALS FLINGS OPEN ITS STOREHOUSES

Treasures of the Stone Belt

The Ural mountain range is called the Stone Belt, extending in a huge arc from north to south. And like an embroidered belt it gleams with myriads of gems and gold nuggets.

The accessibility and variety of the mineral wealth of the Urals has greatly stimulated the development of artistic crafts in the region. Kasli is famed for its cast-iron art work and elegant statuettes highly valued by connoisseurs, there are expert brillianteers in Sverdlovsk and engravers in Zlatoust. In all instances the craft is connected either with metal or with ornamental gems, that is, with all that makes the region famous and constitutes its wealth and which is inseparable from the very concept of "Urals".

Vases of porphyry and the motley jasper, precious malachite caskets and hundreds of other articles made by the skilled hands of Ural craftsmen, including a mosaic map of the Soviet Union, are on display at the Leningrad Hermitage Museum. Exhibited at the Second World Fair in Paris, the map was made of 50,000 pieces of coloured stone: fields and plains are of green jasper, rivers and seas of lapis-lazuli, cities of agates, and so forth. This masterpiece was made by stonecutters, brillianteers and jewellers.

The Ural Mountains are an inexhaustible storehouse of useful minerals. Almost all the elements of

the Mendeleyev table are found there and three-quarters of them are mined.

The Murzinka deposit discovered at the close of the 17th century yielded a fabulous amount of gems.

Today Murzinka is just as famous as Ilmeni, and whenever its name is mentioned mountains of gems rise before the eyes of even those people whose knowledge of mineralogy is superficial.

Academician Fersman wrote that it was difficult to name another place in the world where there were more gems than in Murzinka.

In Koelga near Nizhny Tagil seams of marble emerge almost at the surface. Ural marble ornaments many buildings in Moscow and stations of the capital's underground and also the Kazan and Yaroslavl railway station buildings. Of particular value is the snow-white marble dressing the façade of the Kremlin Palace of Congresses.

The Ural Mountains abound in precious metals. A discovery of gold nuggets in a village is not an extraordinary occurrence. Gold nuggets or cockroaches as they are locally called weighing up to eight or ten grammes have been found by schoolchildren, and housewives extracted grains of gold from the craws and stomachs of ducks and other domestic fowl.

In the thirties, during the reconstruction of the embankment of the Sverdlovsk city pond, it proved necessary to partially drain it. The bottom became exposed in places. Immediately people began to wash the silt for gold. It turned out that there was gold-bearing rock underlying the pond's bed.

As the famous Ural writer Mamin-Sibiryak once said: the Uralians walk on gold.

But it is iron ore that for centuries has constituted the principal wealth of the Ural Mountains, their pride and glory. Iron is more important than gold, or any other metal for that matter.

The Thrill of the First Discovery

The earth reveals its hidden treasures in all manner of ways.

On the corner of Kuibyshev and Wainer streets in Sverdlovsk stands a large building. Built during the first five-year plan period it is the headquarters of Ural geologists. In the spring they set out from there for all corners of the Urals and return with new discoveries supplementing the already long list of existing ones.

Since ancient times Kirghiz nomads knew that in the steppe between Orenburg and Troitsk stands a mountain which attracts iron articles. Acting on this information Soviet geologists, who intensively searched for ore minerals during the industrialisation period, discovered Mount Magnitnaya which shortly afterwards became the site of the Lenin Iron and Steel Works, Europe's largest.

Frequently discoveries are made by chance.

Once two Ural hunters caught sight of a badger's burrow. Setting to work with their shovels in an effort to chase out the animal they found ... a large rock crystal.

Another chance discovery was made by Gavrilov, a worker living in the Asha township. Digging in his orchard on Kulikova Hill, a place which had never attracted geologists, he saw some brown clots of earth which he thought was brown iron ore. He showed them to geologists. What he discovered was not iron, but phosphorite. Kulikova Hill proved to be of immense importance for agriculture, since phosphorite is an excellent fertiliser.

The township of Izumrud (Emerald) near the town of Asbest owes its appearance also to a chance discovery. Early in the last century Maxim Kozhevnikov, a Beloyarsk peasant, searched here for tree-

stumps from which to obtain pitch. Under the roots of a tree felled by the wind he noticed green stones and sent some to St. Petersburg. It was a lucky find, for the stones were emeralds.

People who bring information about a hitherto unknown treasure of the earth are called discoverers.

The Urals Geological Administration has a Discoverer's Commission whose frequent visitors are hunters, pensioners, collectors of stones, housewives, children, who bring along their finds tucked away in pockets, briefcases or wrapped up in paper or cloth.

It is indeed a thrilling experience to discover something that would be of benefit to the people.

Prospecting for Kustanai ores began during the war. Some vague information about them had been available for a long time, and geologists recalled the legend about a young herdsman Sarbai whose name was associated with fabulous treasures that lay hidden in the region since ancient times.

Soviet geologists launched a search for these treasures. Prospecting parties fanned out for hundreds of kilometres across the steppe. But the Kazakh steppe was vast and could not be surveyed within a short space of time.

Once, flying at a low altitude over the area in a U-2 plane attached to a geological expedition, pilot Mikhail Surgutanov noticed that the needle of his compass began to jump to and fro as though it had gone mad. This was a sure sign of the presence of a magnetic anomaly, a silent, but mighty call of the earth. Surgutanov marked the spot on a map and reported the matter to the geologists. That was how the huge Sarbai iron ore deposit was discovered. Mikhail Surgutanov and a group of geologists were awarded the Lenin Prize.

A rare treasure—not one but several iron deposits—was found hidden under the feathergrass of the Kazakh steppe.

The run discovered in the Turgai depression southeast of the Ural Mountains extends for three hundred kilometres. It contains more iron ore than had been extracted and prospected in the course of the past two centuries. Moreover, the Turgai depression contains asbestos, refractory clays, limestone, dolomites and sands suitable for making glass.

Scientists call this flat country “Urals’ Brother”, because of the close similarity of its geological structure with that of the Urals.

The first trainloads of Kazakh ore were smelted in Ural blast furnaces in 1957. On a bright August day a dust-covered freight train laden with chunks of dirty-red rocks pulled up at the platform of the Chelyabinsk iron and steel plant. The chunks were Kazakh martite ore which has the highest iron content. It was a great moment; bands played and the workers were jubilant.

The following year, the miners of the Sokolovsky deposit extracted over a million tons of ore. The flow of iron from Kazakhstan to the Urals increased with each passing day.

Mountains of Iron and Rivers of Fire

The demand for iron has been steadily mounting ever since man learned to smelt iron out of ore and use it for his economic needs.

Look around and you will see that almost everything that surrounds us contains iron. It can well be said that our whole life is shot through with iron.

Day and night red glares dance over iron and steel factories in the Urals. Day and night furnacemen

smelt iron and steel; yet they never seem to produce enough.

The output of metal in the Urals has increased many times over since the establishment of Soviet power. Today the Magnitogorsk Works alone produces more metal than was produced by all the iron and steel factories of pre-Revolution Urals.

Trains carry Urals metal to building sites on the Angara, the Irtysh and the Kola Peninsula. They carry it in the form of machinery, rolled metal, blast furnace and other equipment and assemblies. They bring it to foreign countries. Urals metal is needed throughout the world.

How much ore is required to feed the ever-hungry smelting furnaces?

When operator Boris Nikitin arrived at the Sarbai iron ore mine his walking excavator stood on level ground. When I saw him again two years later his giant machine stood 90 metres below the original level. In this period it had dug a pit deep and large enough to accommodate the Moscow University skyscraper.

A source of iron ore for over two centuries Mount Vysokaya near Nizhny Tagil has become a deep pit. The top of Mount Magnitnaya has disappeared into smelting furnaces and excavators are eating deeper and deeper into it.

The heroes of a novel by Jules Verne descended to the Earth's centre to see for themselves the fiery torrents raging in its depths. Why go that far now? A sight no less wondrous and magical can be seen in the blast furnace shop of the Magnitogorsk Works when the smelt is released.

The blast furnaces of Ural factories have consumed whole mountains turning them into fiery rivers of metal. Thus, dying, mountains give man their strength.

A Region Rediscovered

Not only has the ferrous metallurgy been modernised and transformed into a mighty industry, but literally all branches of the Urals mining and metallurgical industry have been rejuvenated with many new ones appearing alongside the old ones. The entire face of the region has changed. What had once been small villages and townships are now factories, and what had once been the sites of industrial enterprises are now towns. Old cities, now boasting many modern tall buildings, have straightened their shoulders and acquired a totally different appearance.

More and more natural riches are being discovered in the Urals and formerly latent resources are being put to good use.

It has long been considered that the Vatikha amethyst deposit has been exhausted. But I was shown a handful of these gems just recently discovered in old Vatikha. The stones proved to be of excellent quality, that is, they were suitable for cutting, and for their deep violet shade were called "velvets".

The find revived interest in Vatikha. It was surveyed a second time and then turned over for development to the Russkiye Samotsvety (Russian Gems) Trust which mines and cuts industrial stones.

An amethyst mine north of Alapayevsk was given a second start in life. At the close of the 18th century it was flooded by subsoil waters which brought all work to a stop. It stood idle until 1956 when experts with modern equipment arrived and drained the water to discover that it had been worked only to a depth of 30-40 metres. Below they found untouched sockets of amethysts.

There was a time when it was believed that the Urals were insufficiently rich in copper. This was

disproved by geologists who discovered the Bolshoi Gai copper deposits, a sort of a copper Mount Magnitnaya, in Orenburg Region. Usually a mine is worked if the ore has a 0.5 per cent copper content. Until recently the best ore with a one per cent copper content was mined in Degtyarsk. The Bolshoi Gai ore has a 5 and in places 10-12 per cent copper content, and occurs at the easily accessible depth of 60-70 metres. Elsewhere in the deposit ore has been found at a depth of a thousand metres.

Bolshoi Gai became a priority project. Tent townships, rapidly tenanted by the Komsomol members arriving from all parts of Orenburg Region, mushroomed over a vast area. A new place, Gai-Gorodok, appeared on the map.

And what about potassium salt? Over four centuries ago Novgorod merchants set up the first salt-works in the upper reaches of the Kama. By evaporating salt solutions pumped out of the earth they obtained cooking salt which they brought to Moscow. Soviet geologists decided to conduct another survey of the area: the first well disclosed the presence of potassium salt, another well a kilometre away likewise disclosed the presence of potassium salt. After that they sank wells ten, twenty, fifty and a hundred kilometres away and all of them showed the presence of salt. A fabulous treasure lay in the Kama area. Today potassium, the "stone of fertility", flows from there to all parts of the country. The Kama salts also yield magnesium, one of the lightest metallic elements.

I have already mentioned that oil is now being extracted in the Urals. On the banks of the Kama and the Belaya there are numerous derricks and automatic pumping jacks suck up oil from the depths of the Urals earth. Not very long ago Baku was the country's sole source of oil, and when the first oil-

bearing regions were discovered in the Urals they were named "Second Baku". Today Bashkiria alone yields more oil than Baku.

Asbestos also occurs in the Urals. Asbestos is a stone which can be pleated like flax. Separated into strands, it even resembles flax and is used in the manufacture of refractory materials.

Nature did not do the Urals out of its share of platinum and even diamonds, and the Vishera diamond mines are now famous throughout the world.

Recently nephrite was discovered in the region.

Nine or ten thousand years ago nephrite was used in making arrowheads, knives and tools. Nephrite is everlasting. During the reign of ancient Chinese emperors skilled craftsmen made ornaments, statuettes and religious articles out of this green mineral which is incredibly durable and almost defies breaking.

In the Soviet Union nephrite was mined in small quantities only in Siberia. A short while ago, however, large nephrite deposits were discovered in the Nuralinsk Mountains in Southern Urals.

I have mentioned but a few of the discoveries made in the Urals in recent times.

It will not be an exaggeration to say that the Urals is a region rediscovered by enthusiastic and efficient men and women—Soviet working people. Rewarding them for their efforts to increase their country's might the ancient Ural Mountains are flinging open the doors of their secret storehouses.

Kachkanar

The 820-metre high Mount Kachkanar in Sverdlovsk Region is one of the loftiest points in Central Urals. Seen from afar, its giant cloud-capped dome with its gently rounded sides fringed by ancient cedars and firs has served as a landmark for the local

inhabitants since ancient times. Each spring a sea of raspberries and birdberries ripened at its foot, and scattered here and there on the narrow climbing paths lay crystals of hornblende, tight wads of mica leaves and fragments of pyroxene and olivine.

For centuries people washed gold here. But Kachkanar's main wealth is iron ore. There is so much of it that if all of it were smelted and the cast iron thus obtained loaded on flatcars they would form a train which would encircle the world at the equator several times. Admittedly its ore has a smaller content of iron than that extracted from Mount Magnitnaya or Blagodat, but the technology of obtaining metal from ores is being constantly improved and that which had once been discarded as waste is now being put to good use.

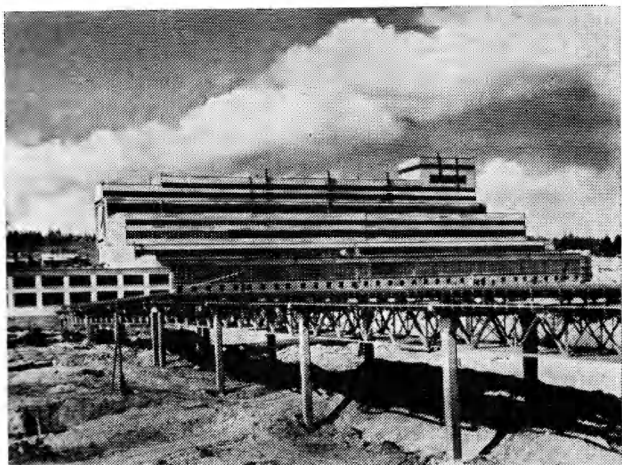
Although of low grade, Kachkanar ore is easily enriched. What is particularly important is that it has an admixture of vanadium and yields naturally alloyed cast iron. Vanadium cast iron is less brittle and is in great demand in industry.

After the Second World War the ore situation in the country became a source of concern for the iron and steel workers. During the war ore was mined without much thought for the future with the result that the old mines that had served man for several centuries became almost fully depleted.

Thereupon the Soviet Government decided to turn Mount Kachkanar into a major source of iron ore.

The Kachkanar project was given top priority. Thousands of Komsomol members responded to the appeal of the Sverdlovsk Regional YCL Committee and hundreds of applications were directed to YCL regional and city committees. Young people left their homes and went to work on the Kachkanar project.

It was not long before axes began ringing at the foot of Mount Kachkanar and white tents dotted the



Kachkanar Ore-Dressing Factory under construction

surrounding area. On the slopes of the adjacent Mount Dolgaya woodcutters made the first clearing for the future township. On display at the Sverdlovsk Museum of Regional Studies is an axe, blunted and with a well-worn handle. It belonged to Anatoly Teplitsyn, a Komsomol member, who in 1957 took part in cutting the road to the future ore-dressing complex. More and more people moved to Kachkanar from all parts of the country.

Like Ships Sailing over Tree-tops

I went to Kachkanar in the autumn of 1963, shortly before the complex was due to go into operation. The moment I arrived a feeling of amazement combined with a sort of glowing excitement gripped me. All around were hills-islands in a green sea of conifer-

ous forests—and like ships sailing over tree-tops rose tiers of white buildings of the new complex.

In contrast to the squat buildings of the old Ural factories sprawling in valleys and along river banks, the new enterprises swoop upward, as though reaching for the sky. It may be said that they are a symbol of the times.

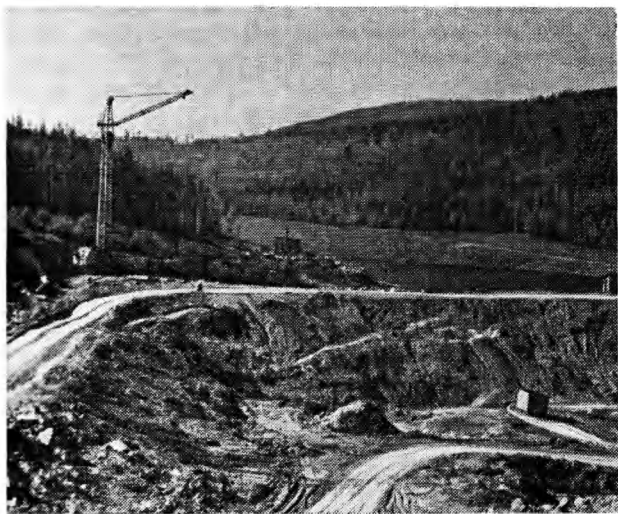
But let us return to Kachkanar.

There is Mount Kachkanar and the town of Kachkanar. The main thoroughfare, Magistralnaya Street, with its numerous branching streets and lanes wreathes Mount Dolgaya with a necklace of high stone buildings. In the centre stands the Yunost (Youth) Cinema. The name is symbolical, for the builders of Kachkanar were mostly young people. The town is divided into residential areas and because of the relief most of the houses were built wherever there was a convenient place for them.

People here like to recall how they felled trees and prepared the building site. The first ore was extracted from Guseva Gora (Mount Guseva). Generally speaking Kachkanar is a conditional name which covers several massifs delimited by geologists into the Main Deposit and the Northern Deposit and several intermediate ones.

One gets the impression that in the main quarry of the Guseva Gora Deposit the mountains themselves decided to surrender their wealth and moved apart disclosing an extensive brownish-black area covered with rocks and ringed by tiers. The valuable vanadium ore lies there for the taking. Excavators are cutting fresh terraces and trains are moving along the bed of the quarry. It is not very deep yet, but an engineer who showed me around said that its level will be lowered to two hundred metres.

“Do you know that bears laired where the excavators are now digging?” asked geologist Vasily Chir-



Construction of a dam on the Viya

kov who was with the first party of prospectors who came to Kachkanar, and set off the first explosion to obtain samples of the ore.

An ore-dressing mill requires vast quantities of water, almost as much as is consumed by such a large city as Sverdlovsk. For this purpose two very large ponds were dug on the Viya river. One holds clean water for the mill, the other is used for depositing sludge and they are called the Viya Storage Lake and the Viya Sludge Storage respectively.

From our vantage point on the dam of the upper pond we could see the Viya far below. The pond's great bowl was only partially filled and several floods will be needed to have it filled to the brim. But in the lower sludge pond which extends almost as far as the eye can see, the water level has reached the

designated mark. The pond is yet another artificial fresh-water sea made by Soviet people, a sea situated almost on top of the Ural range.

According to estimates there is enough ore in Kachkanar to last a hundred years.

On June 9, 1963, the mill produced the first samples of concentrate, and on October 1, 1963, a Government Commission officially announced it an operating enterprise.

Kachkanar, the banner and symbol of the new Urals, stands almost directly on the watershed, on one side of which is the Yevropeiskaya (European) Railway Station and on the other the Asiatskaya (Asian) Railway Station. Seen from both Europe and Asia, Kachkanar symbolises the steadily developing industrial might of the Soviet Union whose production capacities are now rapidly expanding not only along the Stone Belt but also east of the Ural Mountains—in Siberia and the Far East.



Scientists assert that what they call a second Urals, a source of untold riches, lies beneath the Urals.

This thought was first voiced at the turn of the century by the world famous scientist Alexander Karpinsky, a man who became the first President of the USSR Academy of Sciences. He was born in 1846 in the Ural town of Bogoslovsk, which has been renamed Karpinsk in his honour. The latest studies of the region have fully corroborated his ideas.

The second Urals extends to the east and west at right angles to the Ural range, and its development is merely a matter of time.

It is not by chance that geologists are discovering minerals which had never before been found in the Urals.

The Ural Mountains give much to man, but a great deal is still to be done in order to make fuller use of their gifts and force them into complete submission.

The Urals Forges Victory

"The old, grey Urals"—is it really as old as it is customarily referred to? Yes, undoubtedly. Yet it is also eternally youthful thanks to the efforts of the people and new discoveries. Geological Urals not only has a great past and a magnificent present, but a still greater future and the coming generations will draw freely from its overflowing storehouses.

The significance of the Urals as the country's stronghold manifested itself to the full in the most difficult, calamitous periods for the country, for instance, during the reign of Peter I, when the outcome of the war against the Livonians and the Swedes depended largely on the amount of available metal, and in the Great Patriotic War of 1941-1945 when the Urals became the Soviet Army's arsenal and helped it to deal a crushing defeat on the nazi invaders.

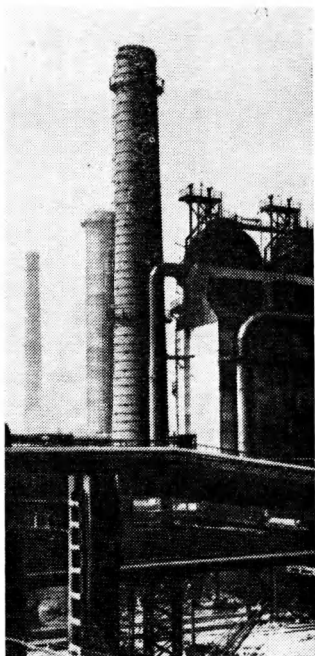
During the war the pupils of a vocational school painted a picture which they called "The Urals Forges Victory". It depicted a bearded giant, his sleeves rolled up and feet firmly planted on the ground, forging a broadsword on a steel anvil. That was how the artists saw the Urals—the worker and warrior.

Some years ago Sverdlovsk sculptors and painters organised an exhibition called "Urals" dedicated to the labour exploits of the people of the Urals. Two Sverdlovsk painters depicted the Urals as a young athlete holding a lump of ore as though offering it to the people. One could almost hear his unuttered words: "It's for you, so that you may live in peace and happiness."

Many great minds of the past believed in the magnificent future of the Urals. Dmitry Mendeleev, the celebrated Russian scientist who developed the periodic law, made the following prophetic observation after a trip across the Urals:

“Faith in Russia’s future, which has always lived in me, increased and strengthened following my close acquaintance with the Urals.”

How gratified the great chemist would have been to learn that his home town, ancient Tobolsk, would soon join the family of “chemical” cities, now comprising the advance line of Soviet industry, that Tyumen and the entire Tyumen Region, adjoining Sverdlovsk Region, an area of the subterranean, or, as geologists say, buried Urals, is developing into a region of wide-scale chemistry, a region of oil, gas and other mineral wealth.



A Town of Workers' Glory



(Three projections
of a mining centre)

I shall always remember my first impression of Nizhny Tagil. Night had already fallen when I arrived and large bright stars hung low from a dark blue, almost black sky. A hard frost made my face tingle. Suddenly half the sky seemed to erupt in a fiery glow which quivered and slowly faded only to flare up again with such force that everything around assumed a bloody tinge. The factory smoke crawling along the horizon was painted a darkening red. One would have thought that a battle raged in distance if not for the silence that should have been blasted by the roar of guns. I was a bit shaken by the unaccustomed sight, but a moment later a feeling of pride welled up within me. They were smelting metal at the Kuibyshev works. Gradually the glow subsided. And immediately another glow reddened the other half of the sky. This time it appeared over another iron and steel plant, the junior brother of the Kuibyshev works.

Seen from a distance Mount Vysokaya, the symbol of the ancient mining town of Nizhny Tagil, looks very ordinary indeed. And it seems surprising that it is this terraced hill that has made the place famous.

Nizhny Tagil is more than just a town of ore and metal: it has a very remarkable image and it is doubtful whether there is another town of its kind in the country. The fact of the matter is that Nizhny

Tagil has a complete production cycle: it has mines where ore is extracted, factories where it is smelted and engineering works which use the metal obtained to manufacture machines. Today the ore will be blasted and loaded by excavators on flatcars, and tomorrow it will become a part of a machine...

How shall I begin my description of the town and what are its most interesting features? Not an easy task, to be sure, for even the production of a single machine is a narrative in itself.

The First Projection: Metallurgical

Before the Revolution Nizhny Tagil had a small iron and steel factory. Built over a hundred years ago it was regarded as a giant in its time. Then in the course of the first five-year-plan periods the Nizhny Tagil Iron and Steel Plant was built. The history of its construction is an epic in itself. There is a plaque in the blast-furnace shop with the inscription: "Moulded from the first cast iron produced at Nizhny Tagil Iron and Steel Plant, July 25, 1940." In the post-war years it absorbed the old factory and the Vysokogorsky, Lebyazhinsky and Goroblagodatsky mines, the coke-chemical, refractory and several other factories and was renamed the Lenin Nizhny Tagil Iron and Steel Works.

There is a strange thing about this works: it seems that it will never be completed. A year or two pass by and new shops are built, adding to its production cycle.

More than a day is needed just to walk through all its shops. Everything about the place is enormous. A line of blast furnaces, each a factory in itself, forms its central axis; to the right and left stand other shops and the horizon is hidden by factory premises which extend for kilometres.

We looked into the open-hearth shop. Through the whitish haze in which electric bulbs glowed with a dim yellow light, we discerned silhouettes of men and machinery; every now and then a livid tongue of flame would shoot up scattering sparks and a stream of molten metal would spout forth. Everything swirled and wreathed as though in the heart of a volcano.

Manned by smelter Zashlyapin, it was indeed a famous furnace. He approached us in his grey overalls with protective glasses perched on the peak of his cap. His movements were quick and agile and his low voice was assured and dignified. By no means a giant in stature, his deeds were indeed those of a giant.

"Do you like your job?" We shouted to make ourselves heard above the roar of the flames.

"Speaking for myself, there is nothing I like more."

Men like him smelted fiery rivers of molten metal and controlled fire-breathing furnaces the very sight of which make some people feel uneasy.

It struck me that I did not want to leave the place.

Next we visited the wheel shop. Recently commissioned, it had not been included in the original project of the works. There was something magical in the way people controlled the flames and the molten steel.

Spellbound we watched how the machine obediently responded to man's will, how easily it moulded metal, pressed out the nave and how the manipulator of the huge annular furnace kept feeding it with blanks. Round and pot-bellied, the furnace slowly revolved around its axis not unlike a gigantic umbrella placed on the ground. By the time it makes a complete circle the blank is heated to the required

temperature. Then it is pushed out of the furnace's flaming maw and the manipulator, as though a living and thinking being, seizes it, turns around and waving its enormously long arm transports it to the machines which will turn it into a wheel.

Clouds of steam swirled to the ceiling as hissing jets of water cooled the metal. After that the wheels, gradually darkening, are transported by conveyors to thermal wells for a long period of cooling.

The finished wheels are delivered to the neighbouring Carriage-Building Works.

Next we visited the converter shop. At first glance there was nothing striking about it. It had a very high ceiling which made it the highest shop of the works, not counting the blast furnaces, of course. There were several workers in the control-panel section including the shop foreman, a round-faced man with a powerful, stocky figure. But what did amaze us was the speed at which the metal was smelted here. He told us that although recently commissioned the shop had already turned out millions of tons of metal.

On our way back we stopped at Rolling Mill 650 manned by a Communist Labour Collective. Situated in a building almost 750 metres long, the mill consists of a very large number of intricate machines stretched out in a line, beginning at a storehouse of ingots and ending at a storehouse for the finished product. In between there are heating furnaces, wells, incessantly moving rollers transporting ingots weighing many tons and the rolling mill itself which shapes heated metal into a long strip of iron by passing and repassing it between its rolls. Rolling Mill 650 is a fantastic pyrotechnical display of fire, and blinding white-hot metal moving with the speed of an express train. All mechanisms functioned with admirable precision. For example, a heated ingot was

discharged from a furnace at a signal from a photo-electric cell precisely when it had reached the required temperature. Released from the furnace it moved forward as though alive. . . .

We observed it from an elevated glass enclosure forming a bridge over the rollers. Glowing ingots rushed below. Two operators controlled their movement and the work of the machines. Seated in low comfortable armchairs they moved the levers of mechanical controllers. They did not watch each other yet their movements were perfectly co-ordinated as though parts of a single smoothly-functioning mechanism. One wrong move and something was bound to go amiss. The third operator took over for a time whenever one of the two got tired.

An inexplicable metamorphosis took place right before our eyes: a stubby, fat ingot turned into a red glowing ribbon which grew longer and longer.

There was a mirror suspended before each operator enabling him to see what was going on behind. The precision of their movements was virtuosic despite the fact that they were under a strain equal to that experienced by a man driving a car at over a hundred kilometres per hour.

The Second Projection: Engineering

The Urals Carriage-Building Works is named after Felix Dzerzhinsky, an associate of great Lenin.

There are four government decorations on the works' gates, four testimonies to its magnificent performance: the Orders of Lenin and the Red Banner of Labour, and the Orders of the Red Banner and the Patriotic War, First Class, the latter two were awarded during the war.

It was with a feeling of admiration that we toured the works.

...The construction of the Urals Carriage-Building Works was started in a forest in the vicinity of Tagil in 1931, and in October 1936 it produced its first four-axled 60-ton open car.

Thus far we have talked a great deal about ore extracted in millions of tons from the Ural mines, and about the metal smelted from it. But ore has to be transported and so does metal and other freight. In those years the Soviet Union was experiencing an acute shortage of freight cars and other rolling stock, and their production was assigned to the Urals Carriage-Building Works. After the war the enterprise began turning out cars capable of transporting 100 tons of freight and produced so many of them that they could have carted away the whole of Mount Kachkanar. But even this giant enterprise had to work at maximum capacity to meet the incessantly growing demand.

Working conditions are excellent. In the shops there is room temperature, clean air, conveyors for removing the filings, and special underground transporters which swiftly and silently transfer workpieces and parts of carriages from one shop to another.

There is a help-yourself bookstall with books and magazines to suit all tastes.

A huge poster in a shop appeals to the workers: "Mummies and daddies, be careful. Observe safety rules. We want to see you come home safe and sound."

The enterprise initiated the movement for high production efficiency and fulfilled all its commitments.

It is the leader in the socialist emulation between the industrial enterprises of Nizhny Tagil and has won a Diploma of Merit at the Exhibition of Economic Achievement in Moscow.

The Third Projection: Chemical

Next to the Carriage-Building Works stands the Plastics Factory, a leading chemical enterprise in Nizhny Tagil. Compared with the Iron and Steel Works and the Carriage Works the factory has a modest appearance. It lacks their impressive size and scope of production. But let us not hurry with conclusions.

The factory could be called an offspring of the Carriage Works; in 1938 a shop was built here which utilised the waste from the Carriage Works' gas generating station to produce resins and later phenol. Two more shops were built during the war. In August 1941 equipment arrived from Leningrad and at the close of September it had already been installed in squat, hastily-built wooden shops which began turning out various plastic items formerly made out of non-ferrous metals.

To most people chemical reactions bring to mind retorts and flasks with mysterious hissing solutions emitting dense clouds of gas.

Instead of all this there are tablets. That is how these button-shaped pellets are called here since the presses swallow them like people swallow medicine. No bigger than checkers (incidentally these are now also made of plastics) they come in blue, yellow, white, pink and many other colours. Staining the hands of workers these tablets resemble chalk and are just as brittle. A worker puts a tablet in a press and out comes a cup, saucer or some other article. It is interesting to note that the colour changes in the process: a pale pink becomes a dark pink, a pale blue becomes a bright blue and so forth.

All the chemistry there is is contained in these tablets. A special shop produces powders containing resins, dyes and other ingredients. The resins are also made at the factory. When pressed the powder be-

comes infusible and indissoluble. That, in fact, is the entire process.

Entering the recently commissioned formalin shop we thought the place was empty. After a while a charming girl appeared from somewhere and showed us some tubes and glass windows through which, according to her, it was possible to see exactly what was happening to the formalin. But not being chemists we found everything very involved.

Continuing our round of the factory we looked into the fluoroplastics shop. We come across fluoroplastics every day without knowing it. Its utility is steadily increasing, and undoubtedly it is a material with a great future.

Fluoroplastics are the basic material of the synthetic industry. A film made of fluoroplastic is a much better insulator than any other known material. Automobile washers and tramcar brake shoes made of this material last for years. Fluoroplastic pipes resist acids. It is impossible to list everything that is manufactured out of this material.

Fluoroplastic is a loose white mass, wonderfully pliant to the touch. It is hard to compare it with any known substance. It is like sand but it is not friable, nor can it be likened to groats, for groats are not viscous. It is rather like snow on a warm day in winter when separate snowflakes stick lightly to each other, and it is of the same wonderfully clear bluish colour. You can almost hear it crunch like snow. But the resemblance is purely outward, for fluoroplastic compresses without a sound.

The production of a fluoroplastic film starts in the press shop where the mass is compressed into heavy discs also called tablets though they are the size of a small round cheese. After that the tablets are baked in a furnace where they acquire a pink colour and become transparent. Then a tablet is impaled on a

lathe spindle and the film is shaved off with the help of a knife. Who could have thought that it was all so simple and at the same time so complicated. The tablet rotates rapidly and the thin, even transparent film which runs off is wound into a disc which is the end product—fluoroplastic electric insulating film.

Other items are baked in similar fashion.

Numerous articles are produced here: ion-exchange resins essential for blood conserving and purifying water; artificial leather and plastic film; ingredients for tyres that make them heat- and cold-resistant; substitutes for lead for cables enabling them to endure longer periods of overheating; water-repellent materials; lavsan which is as tough as a steel film, and so on and so forth.

The factory is gradually turning into a major industrial enterprise.

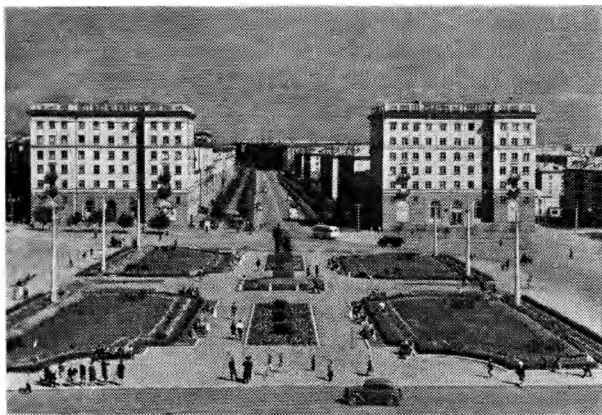
Through the Magnifying Glass of Time

Tagil would not have been what it is today if not for its advantageous site and the variety of mineral wealth it has at its disposal. A rare combination to say the least, and one that accounts for the town's singular appearance.

The results of man's purposeful labour are in evidence everywhere: skilfully built dams and mill-ponds and an intricate system of water mains, for water is industry's life blood.

At this juncture we should like to mention the name of hydraulic engineer Klimenty Ushkov who occupies a prominent place in the industrial history of the Urals. In the forties of the 19th century he submitted a detailed plan for the construction of a system of ponds, sluices and canals.

In it he outlined methods of using spring floods to accumulate water and drain its surplus, of streng-



A street in Nizhny Tagil

thening the slopes of water courses to prevent their washing away and subduing the water if and when it should go wild. He supervised the construction of a five-kilometre-long canal, several dams and other structures. The canal which carried water to Tagil and the town pond became operational in 1848.

The Ushkov water-supply system, a relic of the old mining Urals, is still functioning.

The Cherepanovs, father and son, famous self-taught mechanics from Nizhny Tagil, invented their locomotive, one of the world's first self-propelled steam engine on wheels.

In Soviet times a bronze and marble monument was erected in their honour in Theatre Square in the centre of Nizhny Tagil. The City Council and the CPSU City Committee instituted a Cherepanov Diploma which is awarded to foremost rationalisers and inventors of the city.

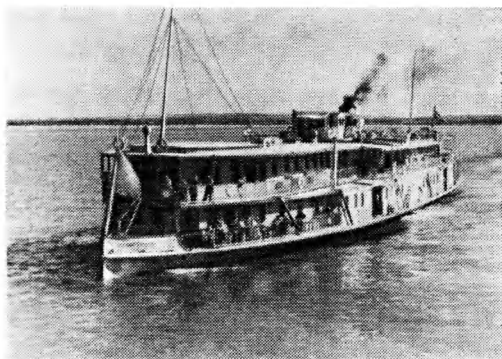
Another local inhabitant Yefim Artamonov invented and constructed a bicycle as long ago as 1800. In

1801 he cycled from Nizhny Tagil to St. Petersburg. He started out on May 9 and within four days reached Perm, 560 kilometres away. Thirteen days later he was in Kazan. From St. Petersburg he cycled to Moscow for the coronation of Alexander I. There he had a stroke of luck. He was given 25 rubles and a letter of enfranchisement. Starting out from Nizhny Tagil a serf, he returned a free man.

Artamonov invented the bicycle long before it appeared abroad.

Nizhny Tagil today has 400,000 inhabitants. Because of its original layout it seems to be coming forward to meet you. Its new broad streets are lined with five-storey stone houses. The new city is spreading out to the quiet outlying streets. One can already discern what the city will be like in the near future.

There are many old-timers who are a living link between the past and the future. They remember a great deal. They remember Ordzhonikidze's visits to Tagil during the first five-year plans and the thunder of ammonal explosions on the construction sites of the Iron and Steel Works and the Carriage-Building Works. And they see the fruits of their labour.



A Voyage Aboard the "Mayakovsky"

*(Along the Upper
Kama, the Vishera
and the Kama Sea)*



**The voyage begins.—
On the eve of great accomplishments.—
The end of the Kama Fleet**

And so I will be among the passengers of the *Mayakovsky* due to set sail at eleven in the evening.

Have you ever sailed along a mighty river on a passenger ship? A feeling of pleasurable anticipation steals over you long before you see the river itself, and time seems to drag on interminably before you are allowed on board. As regards myself, I was doubly impatient, for the last time I had sailed on the Kama was 25 years ago when I was a student in Perm. Then I sailed downstream. Now, at long last, I shall see it again, but this time I shall travel upstream.

Finally, it was time to board ship. Something stirred in me as I strode over the bending gangway and found myself on the ship which was getting up steam with loud sighs. The stevedores rolled booming barrels and carried heavy bales which they lowered into the hold. The shouts of the stevedores, the hubbub of the crowd on the landing and on deck, the moist coolness rising from the water coupled with the smell of tar, stained wood, hot lubricants and salted fish created an atmosphere of expectation unlike anything one may feel on land. The deck began to quiver and pulsate in time with the engine, the whistle sounded, the gangway was pulled aboard and we were off.

The *Mayakovsky* was neither the newest nor the biggest ship on the Kama. She had two decks, first and second class cabins and a lounge.

It was September 17, 1953, somewhat late in the year for a voyage on the Kama, particularly along its upper reaches. But there were reasons which induced me to undertake it and not wait till the next navigation.

The *Mayakovsky* was one of the last ships scheduled to make a direct trip from Perm to Krasnovishersk. Within a few days the builders of the Kama Hydroelectric Station, which was going up slightly upstream of Perm at the mouth of the Chusovaya, were to block the Kama and erect a high dam which would forever cut short the mighty river's unimpeded flow.

This was the topic of conversation in the shipping offices, various city organisations, at the river port and in the streets. It was difficult to imagine all the changes that the construction of the project would bring about. The Kama would be channeled into a new bed and, stemmed by the dam, its waters would flood a vast area forming yet another fresh-water sea in the country. The contours of the river banks would change and those sailing along it the following year would find it changed beyond recognition.

The *Mayakovsky's* heavy sighs had long given way to the monotonous measured splashes of the paddle wheels against the water as she forged between the twinkling red and white lights of the fairway. To the right glimmered a long chain of yellowish dots—the lights of factories, timber yards, and workers' townships on the outskirts of Perm. The night shrouded the buildings; neither could I discern where the black rippling water ended and the banks began. As a result it seemed that the Kama was much wider.

Gradually more lights came into sight and not only along the right bank. There were clusters of them directly in front of the ship and one got the impression that we were sailing right into their glare. Passengers flocked on deck to gaze at the fascinating sight.

"It's the Kama Station," a voice boomed proudly.

The beat of the wheels on the water grew louder as the ship encountering a stronger current entered a narrow channel. On the right a long earthen dam jutted out into the water and on the left was what all the passengers were looking at: a high iron wall rising across the river. Made of tightly fitting grooved iron boards driven into the river bed, its reddish-black surface covered with patches of rust, the wall resembled a huge pleated skirt. Two rows of electric lights, one on top of the wall, the other just above the surface of the water, lit up the river. The wall was like a cliff. Extending half-way across the river it turned at right angles to follow the channel and then turned again towards the bank forming an enormous water-tight box in which the building of the hydroelectric station was being erected.

Judging by what we could see it was a gigantic project. Powerful spotlights illuminated the cranes that moved along the crest of the wall, their tops invisible against the black sky.

"Stupendous, isn't it?" said someone standing next to me. It was not clear whether he was referring to the river which would soon turn the giant turbines of the station, or to the people who by their labour had harnessed the waters of the mighty river. "It will be a magnificent monument. . . ."

"A monument?" I asked, mechanically watching the panorama of the construction site fade away in the darkness.

"To what happened here over thirty years ago."

Turning my head I saw a tall, powerful man. His face was lost in a dark shadow and I could only discern his large strong hands gripping the railing lit up by the ship's sidelight. The deck was in darkness. The passengers had returned to their cabins and only the two of us remained on the bow peering ahead into the night.

"Take a look over there," he motioned with his hand. "No, not there, that's the house-building complex. Look further ahead, you can just see . . . in the direction of Lyovshino. In the mouth of the Chusovaya there is a large landing there."

With a sigh he fell silent. I did not press him and was shortly rewarded for my patience.

"It happened in 1919, in the summer. There was fierce fighting on the Eastern Front. The Red Army was close on Kolchak's heels, and things were pretty hot on the Kama. Caught between the Red Volga Flotilla which was pushing upstream and the partisans attacking along the banks from the rear, the whiteguards who were retreating with battles mined the Kama. In these battles nearly a hundred ships and innumerable barges, landings and other craft were burnt or sunk on a small sector of the front.

"But that did not save them, I mean the whiteguards. The Red Army was due to take Perm in another day or two. That's when it all happened. I remember everything as though it was yesterday. It was close to midnight, dark enough for dark deeds. Massing about a hundred remaining ships and tugs and some fifty barges and landings in the mouth of the Chusovaya, the whiteguards released about 30,000 tons of oil and kerosene from Lyovshino tanks into the water and set it on fire.

"In a second the place was a roaring inferno. Ships, the river itself and everything in the vicinity was enveloped in flames. It was light as day. And

when the local inhabitants, many of whom were river transport workers, rushed out of their homes in an attempt to save something, the whiteguards opened up with machine-guns. A large number of people were killed and nothing was saved. And nothing could have been saved. It was impossible to come anywhere near the flames.

"The conflagration lasted for two days. During the day it was dark as night from the smoke, while at night it was light as day. The thick black smoke from the burning oil obscured the sky, blotting out the sun and the stars. Blazing like torches ships floated down the Chusovaya and entering the Kama sank. One ship, its whistle wailing as though bidding farewell to life, floated into the Kama and went to the bottom, its whistle going to the last."

Warmer and I would say exultant notes crept into his darkly solemn voice:

"But we restored everything and made a fine job of it, too. As soon as the whites were chased away we began salvaging the sunken ships. It took some time to repair them. The job was completed when the first five-year-plan period was already on. As regards the present, well, I would say that it speaks for itself: just look at that giant scheme. That's why I call it a monument."

He fell silent. Once again my ears caught the sound of the water swishing at the bow and the monotonous slap-slap of the paddle wheels taking the ship farther and farther away from the spot of the old tragedy.

The September night swallowed Lyovshino and the lights on the river banks. Ahead twinkled the red and white stars of the merrily rocking buoys.

**How old is the *Mayakovsky*?—
Before a sea is born**

We stood on deck and watched the banks float by as our old but still spirited *Mayakovsky* stubbornly pushed ahead against the strong current.

It was a dreary morning. Low, rain-laden clouds blotted out the sky. By midday it began to rain but braving the weather we remained on deck occasionally moving from the windward to the leeboard side.

It was engrossing to observe the changing scenery and the activity on the river.

Every ninety minutes or so caravans of rafts would float past, sometimes, forming a long chain (the rafters were in a hurry for the river would soon be blocked). While still at a considerable distance from them the *Mayakovsky* would emit a harsh whistle and the mate would signal with a flag indicating the ship's course.

Sometimes a warning bell would sound from a raft.

"They are asking us to slow down," an initiated passenger would remark. His words would be immediately confirmed: the *Mayakovsky's* paddle wheels would stop beating the water and it would move ahead slowly, carefully until the raft was passed.

The river was a busy place resounding with the shrieks of ship's whistles and the chugging of motor launches.

The dark-green patches of woods alternated with the emerald squares of the fields planted to winter crops. But the farther we moved northward the denser became the coniferous forests.

At Ust-Garevaya the landing was on a steep bank. To the left extended a huge depression barely visible through a whitish curtain of rain. It was filled with water when the dam of the Kama scheme was com-

pleted and all the houses down below had been shifted to a higher place.

"It'll be flooded up to that dark line." The speaker, a powerfully built man with a sou'wester over his greatcoat and peaked cap with the insignia of the river fleet, pointed to the bank. Standing with his legs far apart in the habitual posture of a sailor, he fixed his eyes on Ust-Garevaya with the evident intention of checking on whether all preparations had been completed for the flooding operation.

"A lot is going to change here," I ventured.

"Sure enough. Many villages will be flooded. A major event for the people here. It's more than just moving from one spot to another. It's also a complete change of life. Many will have to acquire new professions. No one, of course, will be left without a job. They are planning to build a shipbuilding yard in Chyormoz, for example. Well, as regards us, river transport workers, we'll have plenty of work when the sea is formed."

The conversation switched to the *Mayakovsky*. The ship was built in 1904 and in the thirties was transferred from the Volga to the Kama.

In 1954 it would turn fifty. Though rickety it still plied the river with passengers and cargo. Nevertheless the changes on the Kama will evidently affect the respected veteran which will have to give way to modern vessels.

We passed Sludka, a lovely village on a high steep bank at the mouth of the Obva, from where slowly moving rafts joined the caravans of rafts floating down the Kama. Sludka is famous not only because of the many prominent captains it gave the river fleet, but also because of the interesting archaeological discoveries which were made in its vicinity.

The next place we passed was Chyormoz which has written a page into the country's revolutionary



A raft on the Kama

movement. In the spring of 1836 factory workers and employees, all of them young serfs aged between seventeen and twenty-seven, formed a secret society here.

Its existence was shortlived, however. At the close of the same year the entire group was arrested, betrayed by one of its members. Its organiser Pavel Ponosov and one of his associates were put in irons. In the home of one of the arrested the police found a handwritten poem by the Decembrist Ryleyev. This was a clear indication of the spiritual links that existed between the group and the Decembrists.

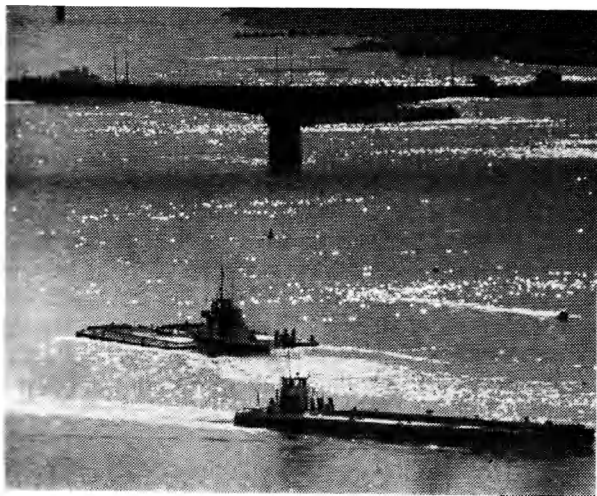
The case of the Chyormoz revolutionaries attracted the attention of Tsar Nicholas I and the entire group was brought to St. Petersburg and incarcerated in the Peter and Paul Fortress. Mention of the secret convicts is contained in old documents.

The remarkable thing about this historic fact was that even here, in what had once been a remote corner of Russia, there were people who boldly raised

their voices against poverty and injustice, against the landowners and the tsar. And to be sure, it was not by accident that in 1905 one of the first Soviets of Workers' Deputies to appear in Perm Region was established in Chyormoz.

After the October 1917 Revolution the Chyormoz workers formed one of the first Red Guard detachments in the Kama area.

Beyond Chyormoz the Kama is joined by the Kosva, its left-bank tributary and almost at the same place by the Inva, a large right-bank tributary. At this spot the Kama Sea would have the greatest width: some 30-40 kilometres at high water. Preparations for flooding were in full swing. Here and there pillars of smoke rose to the sky: workers burned wind-fallen trees and branches and cleared the bottom of the future sea.



The Kama

Passengers remained on deck gazing with interest at the construction site of the Kama project, trying to distinguish the contours of the future hydroelectric station.

The Kama was the subject of the conversation in the lounge where an engineer from the Kama Hydroelectric Station, whose acquaintance I had made on board, and I dropped in for a cup of hot tea. There were two other men besides us. One of them was the man in the sou'wester with whom I talked when the *Mayakovsky* stopped at Ust-Garevaya. Now he wore a dark-blue service coat with the silver shoulder-boards of a river transport worker. The other was a stranger. The two were playing chess by a huge front window of the lounge, but they seemed to be more absorbed in what appeared to be friendly argument about the Kama.

"You cannot even imagine how the Kama will change," the uniformed man said, looking first at the board, then at his partner and then out of the window on which a fine drizzle had drawn tiny streams of water. "It's easy going now, when there's plenty of water in the river. But what about the summer months? Navigation is possible only up to Ryabinino. Rapids and sandbanks; that's why there is no passenger traffic between Ryabinino and Krasnovishersk in the summer, and cargo has to be reloaded from big to small ships at shallow spots.

"We began work on the Kama project after the war. The construction of the foundation was started in the summer of 1951 and in the summer of 1953 the Kama was blocked. In the spring of 1954 water was diverted into the storage lake and a canal was opened for navigation. Several months later the hydroelectric station began generating electricity."

He spoke as though all this had already taken place and no one even thought of correcting him. Nobody

doubted that everything would happen exactly as he said. (Looking ahead I should like to mention that I witnessed all the memorable stages of the subsequent power development on the Kama).

"Let's take navigation again. The Kama Sea will considerably shorten the distance between the main points since in some sectors the routes will be straightened out and new ones will be charted so that there'll be no need to follow the meanders of the fairway. But that's not all. With the completion of the Kama project ships will be able to sail along Kama's tributaries—the Inva, Obva, Chusovaya and Kosva—and even along the Sylva, a tributary of the Chusovaya. All of them will become navigable to a considerable extent. And do you know what this means? It means that a tremendous burden will be lifted from rail and automobile transport."

As he was listing the advantages accruing from the transformation of the water economy of the Kama area, or the Western Urals as it is now called, I remembered all I knew about the Kama.

Extending for 2,000 kilometres, the Kama is the most important waterway in the Urals. The Ural River, which is slightly longer, is no match for the Kama for depth, beauty and particularly economic importance. Among the rivers in the European part of the country only the Volga and the Dnieper are more important, but even so the Kama can vie with them for the beauty of its banks and navigability.

Kama has always been a convenient water route to the Urals. It is truly a gateway to the Urals. The Kama was the "tsar's road" to Siberia. Yermak and his men sailed up the Kama to conquer the lands lying east of the Urals. He turned into the Chusovaya, wintered there and then continued his quest.

Springing in the northeast of the European part of the USSR, the Kama takes in a large number of

tributaries, including such important ones as the Vishera and Chusovaya, and in its lower reaches the Vyatka and Belaya. It has a sinuous channel, a fast current and its mean fall of stream is twice that of the Volga. In its upper reaches the Kama flows north, then swings to the east and encountering the Ural foothills swerves sharply to the south to pass Perm where it gradually turns to the southwest and passing Kazan merges with the Volga.

Volga's main tributary, the Kama irrigates a territory almost the size of France.

"A mighty river," said the riverman pensively. He was looking through the window which offered a good view of the broad expanse of water painted steel-grey by the overcast sky.

"M-hum," grunted his companion. "Wouldn't you be interested to know that this might springs from a wooden trough which can be stopped with a cork."

No, he was not joking. His face was serious enough despite a merry twinkle in his slightly narrowed eyes.

"You mean you've actually seen Kama's headwaters?"

"Indeed I do. You people here, it appears to me, like to travel by ship, but I like walking, and so I took a walk to the place where our Kama first appears on the surface."

"You've got to tell us all about it."

"There's nothing much to tell. Streams.... Yes, ordinary streams. In Kuligi Region of the Udmurt Autonomous Republic. Near the village of Karpushata. That's why they call the Kama Karpushinskaya there. From the village of Vereshchagino, rather from the town of Vereshchagino in Perm Region, once a village now a town—you can reach the place on foot. At first there's just a tiny spring with cold, translucent water. Surrounded by a small fence, it is sheltered under a wooden roof, like those over wells.

That's your Kama. It makes its first run overland along wooden troughs. Whenever it is necessary to store some water the Kama can be corked. It's still too weak to push the cork out. But three or four kilometres downstream it takes in several other streams and is strong enough to turn millstones and generate electricity for two collective farms—they have their own hydropower stations, small ones, of course. That's all there is. Nothing to marvel at. What I'm driving at is that you can plug the Kama, the mighty Kama with a cork. What do you say to that, eh?"

"When have you been there last?" asked the riverman, politely ignoring the jab. He seemed just as interested as we were.

"Well... I don't know exactly," the other said warily. "I suppose it was a long time ago."

"I gathered as much. You're absolutely right about the streams. But I'm not so sure about the wooden troughs. I suppose you did see them, but now..."

"Now?"

"Now there is a water main leading from Karpushata to Kuligi. The Kama no longer flows along wooden troughs. Life doesn't stand still, everything changes, even Kama's headwaters. The streams have remained, of course, and it is they that are now considered to be its headwaters."

**Orel-Gorodok, former capital
of the Stroganov domain.—Captain Pirozhkov's exploit.—
A city of chemists.—A gift from the Permean Sea**

"Orel," said a passenger pointing to a group of buildings of a large inhabited locality which could be discerned in the distance.

Built on an elevated spot on the left bank of the Kama, Orel is one of the most interesting localities in the Kama area. Initially called Orel-Gorodok or

Kergedan it was founded in 1564 and was the main stronghold of the Stroganov family of merchants on the Kama. For a long time it was their residence. On the river bank stood a fort which withstood many an attack. It was in Orel-Gorodok that the Stroganovs outfitted Yermak and his men for their conquest of Siberia.

The Stroganovs and the Demidovs figure prominently in the chronicles of the Urals. In fact they divided the entire Urals between them. The Stroganovs ruled the western slope of the Ural range and the Kama area, while the Demidovs held sway on the opposite side of the range spreading their influence into Siberia as well. In some places their domains alternated or wedged into neighbouring ones, but in general their spheres of influence were clearly defined. These two merchant families were the uncrowned sovereigns of a vast area, the absolute owners of all its untold riches, most of the factories and mines. Outwardly submitting to Moscow's decrees they ruled with a rod of iron and raked in fabulous profits.

But that is not the only thing that has made Orel famous.

It is the home town of some of the Kama's greatest captains. In contrast to Sludka, which produced prominent captains of passenger ships, Orel has given the river outstanding captains and navigators of cargo vessels and tugs. These men had lived in what are known as "captains' houses". Rising in tiers in the central part of Orel these sturdy two-storey log houses with gable roofs form a quadrangle around the central square with a stone church, the main architectural monument of the past in the centre. Undoubtedly these houses—there are several streets of them—which are a distinguishing feature of Orel can be regarded as part of the region's material history.

Any schoolboy here knows of the exploit performed by a local inhabitant, hero of the Civil War, Yakov Pirozhkov.

It happened in the grim summer of 1918 when Soviet Russia was encircled by a ring of fronts, and Kama rivermen, industrial workers and Baltic Fleet sailors, sent to the Urals by the Central Committee of the Party, were hastily arming the ships mustering them into the Kama Flotilla in preparation for decisive battles. Kolchak's troops and the interventionists were moving from the east. Counter-revolutionary uprisings led by kulaks and Socialist-Revolutionaries flared up in Izhevsk and Votkinsk. Rebel detachments were making attempts to gain control of the Kama.

Captain Pirozhkov of the tug *Tovarishch* received orders to tow a barge with a large group of Red Armymen and land them in the rear of the rebel detachments.

Two cannon were mounted on the tug and the wheelhouse was covered with thick steel plates.

The *Tovarishch* was ambushed by seven armed whiteguard vessels. Camouflaged with tree branches, they lurked in the shadows of a wooded bank.

A squall of artillery fire supported by machine-guns and rifles descended on the tug. The enemy had an overwhelming superiority: fifteen cannon against two, seven ships against one. But the captain accepted battle. Its two guns firing incessantly, the tug continued on its way. Water seethed all around from bursting shells and the tug itself was enveloped in flames and smoke. Though wounded by a shell splinter Pirozhkov remained at his post in the wheelhouse. The tug broke through the ambush, but it was seriously damaged and would have been unable to make the remaining several kilometres. In the circumstances Pirozhkov took the only correct decision,

and that was to land the force immediately. But just then he was seriously wounded in the head and shell-shocked. His wound bleeding profusely, Pirozhkov nevertheless managed to steer the tug towards the bank. The entire group disembarked and at the double set out for the original destination. The wound cost Captain Pirozhkov his eyesight.

After the Civil War he returned to his native town of Orel where he first saw the light of day. People up and down the Kama knew about his feat and passing ships blew their whistles in salute. He died in 1947 but to this day many old people on the Kama remember his small dry figure in a trim naval jacket with a tight collar and inevitable dark glasses on his cleanshaven face.

The *Mayakovsky* had pushed off and Orel was receding into the distance, but we remained on deck trying to guess which one of the "captains' houses" belonged to Yakov Pirozhkov, a true patriot and one of those courageous men who are the pride and glory of the Soviet land.

Our next stop was at Usolye, the town of Kama saltworkers. Beginning from here we would pass places whose history goes deeper and deeper into the centuries.

The town with its ancient five-domed church and old wooden houses, its saltworks now in disuse and rare clumps of trees, occupies a huge flat shoal. But on the opposite bank, on which all eyes were fixed, there was a magnificent panorama of factories symbolising the triumph of emancipated labour in a once sombre and uninviting region. It is the site of Berezniki, a town which appeared in Soviet times, the centre of the Urals chemical industry. Next to it is Usolye, founded by Stroganov in 1606, Lenva, that was built just four years earlier, and Dedyukhin, a formerly demoted town which arose around a salt-

works, seem to be very unimportant. The old salt-works have long been abandoned; salt is mined in other places and not at all like it used to be.

Berezniki proper is hidden from the landing, but learning that the *Mayakovsky's* departure would be delayed because of unscheduled loading we asked the captain how much time we had at our disposal and promptly set out for a tour of the town.

Considered to be one of the greenest towns in Perm Region, Berezniki for a considerable period held one of the leading places in the RSFSR for landscape and shade gardening.

The planting of trees in the streets and squares of such a town as Berezniki must have been a particularly difficult job; nevertheless, the Pyatiletka Street is richly arrayed in a mantle of trees whose autumn leaves created a riot of colours. The lawns and gardens along Lenin Street were submerged in greenery and the Treugolnik Park could have added to the beauty of any European capital.

The maple, honeysuckle, lilac, white birch, linden and poplar grow side by side on the streets, gladdening the eye and purifying the air. They bloom in defiance of the frost which sometimes occur in mid-July and sub-zero temperatures which are registered almost every year on August nights.

Thanks to the green belt the air in this chemical centre is clear and fresh and almost without a trace of the harmful factory smoke. On hot days the streets are always shady and cool and what is also important the green attire accentuates the lovely architecture of the buildings.

Berezniki factories manufacture potash, baking soda, dyes, reagents for photography and the cinema industry and nitrogenous fertiliser.

As regards Usolye, which has close economic and cultural ties with Berezniki, it has been turned into

a health centre for people afflicted with rheumatism who get salt-bath treatment in the old Stroganov mansion standing in a poplar grove.

Usolye is the home town of the celebrated Russian architect and painter A. N. Voronikhin, a former serf of the Stroganovs, who designed and built the world-famous Kazan Cathedral and the Mining Institute in St. Petersburg. The church whose architecture attracted our attention was also built by this talented son of Urals salt-workers.

The *Mayakovsky* sailed past Pyskor which the Stroganovs founded before Orel-Gorodok. But it was Solikamsk, the oldest centre of Russian colonisation of the Kama area, which particularly interested me.

We approached it in the thickening autumn twilight. The town proper stood on the bank of the Usolka River, several kilometres from the Solikamsk pier on the Kama.

Quite probably many people today are unaware of how important salt was in the port. Common salt, which we take for granted just as matches and other daily necessities, was one of the principal items of international trade several centuries ago. There were wars for salt, workers were paid in salt and it was used to pay off enemies. History records salt mutinies raised by the people whose rulers failed to lay in an adequate supply of salt.

For a long space of time Russia imported salt from afar. But in the beginning of the 15th century the brothers Ivan and Terenty Kalinnikov reached the Kama during their travels and discovered numerous brine deposits. They began to mine salt and became the first salt manufacturers on the Kama.

In 1430 they built the first salterns on the Usolka and dwellings sprang up around them. Thus the village Sol Kamskaya appeared which subsequently developed into the town of Solikamsk.

As time went on Solikamsk acquired wealth and importance, and at one time as an administrative centre of a vast province it became so powerful that its influence spread to Kungur and Shadrinsk situated hundreds of kilometres away. It was in this period that the most prominent architectural monuments in Solikamsk were built: two cathedrals in the old-Russian "wooden" style, but built of stone, the governor's mansion with walls two metres thick and underground passages leading to adjoining buildings and a nearby forest, and a number of other structures. Today there is a special workshop in the town to keep them in repair.

Solikamsk's decline set in with the discovery of solar salt in Lake Baskunchak in the Volga area. Its extraction proved to be less expensive and the deposits were situated closer to consumption centres.

In 1896 it was learned that Kama salt deposits contained potassium. At the time, however, this discovery passed unnoticed and the extraction of potassium salt did not start until after the October Revolution of 1917.

The first derrick was assembled in the vicinity of Solikamsk in August 1925. Gradually it was joined by others with the result that a vast area containing potassium salt deposits was prospected. These tremendously rich deposits are a gift of the ancient Permean Sea.

The construction of the Solikamsk Potassium Works commenced in 1927 and with its completion the economy of the USSR acquired a new and important branch of the chemical industry.

Tremendous difficulties had to be overcome in sinking the first potassium mine. Potassium salts were formed as a result of the drying up of the Permean Sea. Yet salts easily dissolve in water. Why then were they not dissolved by underground waters? Be-

cause salt beds rest between clay strata which are impermeable to water.

But when the shaft was sunk there arose the danger of waters flooding the deposit, since it cut through the protective layers of clay. The presence of numerous subsurface streams threatened to bring all work to a stop. But a way out was found. The pit was frozen. This was done by ringing the shaft with large-diameter pipes containing a freezing mixture with a temperature of -45°C . Several months passed before the walls of the pit became completely frozen and the water had turned into ice making it safe to continue work.

Soviet mining engineers solved the most complicated technological problems and the extraction of the Kama salts was launched.

Built after the Great Patriotic War, the Berezniki Works is even more powerful than the Solikamsk Potassium Combine, the first enterprise of the Soviet potassium industry.

Neither was magnesium forgotten. In 1933, the Soviet Government authorised the construction of a magnesium factory in the Urals, and today the Soviet Union produces all the magnesium it needs.

Metal from salt, is this not a miracle of modern technology? Magnesium is used in combination with other metals to produce alloys that are as hard as the best of steels and much lighter than aluminium. Magnesium alloys are used in the construction of machine parts, precise instruments and, of course, aircraft. The aircraft industry is the main consumer of this metal.

Where rafts are made.—Kama forests.—The Vishera

On the second day of our voyage we were still sailing along the flooded zone.

We passed Borovsk, formerly the village of Ust-Borovaya. Now it has a shipyard, a factory turning out wooden house parts and a large pulp and paper mill.

Timber is the life-blood of Borovsk's industry. Besides manufacturing newsprint, the mill puts production waste to good use. For instance, it makes alcohol out of the sugar contained in alkalies, and yeast. There is also an old saltworks in the town.

We had a good view of the pulp and paper mill which stands on a hill.

Next we passed Tyulkino, a major raft-making centre on the upper Kama. From here giant rafts are floated to the Caspian Sea, via the Kama and the Volga.

There is something about this tidy riverain locality with its wooden houses which unmistakably indicates that the activity of the inhabitants is closely connected with timber. Endless plankways with rafters working on them extend along the water.

Further down, on the opposite bank, the Solikamsk Potassium Works has an experimental agricultural station called Tyulkino established specially for the purpose of testing the effect of potassium fertiliser.

Tyulkino disappeared from sight a long time ago, but the wooden plankways with people working on them still extended along the bank. As a matter of fact the roadstead where rafts are made stretches for something like fifty kilometres.

Still more impressive is the Kerchevsky 70-kilometre-long raft-making roadstead, which starts a short distance from Tyulkino, above the mouth of the Vishera.

Naturally, the conversation on board the *Mayakovsky* centred on forests and timber. Flowing as it does among thick forests the Kama is a major raft-

ing river. I discovered that rafters get the timber from the lumberjacks at the timberyards closest to the communication lines. There the logs, which are raw material for factories, are made fit for rafting. To make sure that a raft reaches its destination without mishap cables are tied around it after the fashion of barrel hoops. Towards the end of the rafting season a careful watch is kept over the water temperature to ensure that the rafts reach the consumer before the river freezes over.

The Perm Region is a major paper manufacturing area of the country. Here, on the Kama, the finest quality paper, including paper for banknotes, is made.

The Kama forests abound in fur-bearing animals and wildfowl. There are bears, foxes, gluttons and lynxes and also elks which are hunted only by special permission. Of the small fur-bearing animals there are hares, squirrels, martens, mink, polecats, Siberian ferrets, the *kidas*, a cross between a marten and a sable, and the most valuable of all Ural animals, the sable. There is also the muskrat and the beaver which were resettled here in Soviet times. So far beaver hunting is strictly prohibited. Incidentally, beavers once lived in the Urals, but they were all exterminated, and now they are being bred anew.

Of the wildfowl the most important are the grouse, duck, hazel-hen, partridge, woodcock and the migrating wild goose.

The further upstream the *Mayakovsky* sailed the more beautiful the Kama became. Its high banks were cut by picturesque valleys and all villages which we spotted from the deck stood on hills overlooking the river. The windows of their sturdy log houses gazed invitingly at the ships sailing past.

At sunset the *Mayakovsky* turned sharply to the right and entered the mouth of the Vishera. Further

upstream the Kama was unnavigable. Some eight kilometres ahead it was blocked by a specially fenced-off stretch of water where floating timber was trapped, stored and sorted.

And so we were on the Vishera. On a small green cape stood a buoy-keeper's house surrounded by fishing nets. Close by was a striped post with the figure "O" painted on it. I had always wanted to see the Vishera, having heard of its beauty and the legends connected with its name. It flows much faster than the Kama, and at times the splashing of the paddle wheels was drowned in the loud hissing of the water at the bow. Unlike the Kama, the water was clear and sparkling.

An enchanting change of landscape: sandy shoals which could well be the envy of the best Black Sea beaches.

The Vishera carries a great deal of water; accepting it the Kama becomes deeper and wider.

Frolovo was our first stop on the Vishera. The landing stage had been carried away by the swift current, and there was a tug snuggled against the bank. A boat pulled up to take the passengers ashore. The rowers had to pull hard on the oars to beat the surging current.

After Frolovo the *Mayakovsky* dropped anchor at Redikor, a large village climbing down a steep bank. There was a group of passengers waiting to be taken on board on the landing stage. Here the bank was covered with chips of rock and the slope was overgrown with upright spruces.

Soon after we passed Redikor the scenery changed abruptly. The hills receded into the distance and the horizon moved further away exposing a lowland plain. Covered with thick bushes in their autumn attire it resembled a carpet of gold. Almost at right angles to the present river bed there is a long creek

called Redikorsky Poloi and a bit further upstream, on the opposite bank, another creek, the Onikovsky Poloi, flows into it. About a hundred years ago the bed of the Vishera passed at this place. There is a multitude of isles here and a labyrinth of tiny streams winding their way amidst dense shrubbery. A haven for water-fowl, the area is flooded in the spring. In fine weather there is a good view of Polyudov Kamen, one of the most picturesque cliffs of the Northern Urals.

**Krasnovishersk of paper fame.—
Polyudov Kamen.—The return trip**

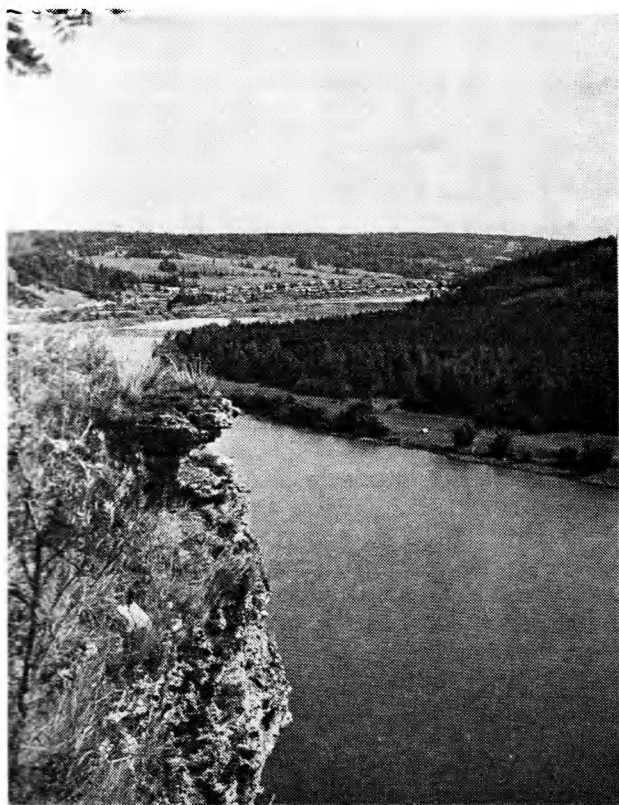
In the morning we were wakened by the sound of thuds which shook the *Mayakovsky* and echoed dully throughout the ship. It was as though something heavy was striking the ship's bottom. I went on deck and saw that the noise was made by huge bales of paper which the stevedores were rolling into the hold. The ship was tied up at the pier of the Vishera Pulp and Paper Mill. Frost sparkled on the roof-tops and silvered the grass. I felt the cold penetrate to my bones.

We were in Krasnovishersk, the northernmost town of Perm Region. And although it was only the 20th of September the weather was freezing.

Krasnovishersk was built in the first five-year-plan period. Standing on the elevated left bank of the Vishera, it seems to be gazing at its reflection in the water.

The Vishera Mill manufactures white paper of high quality suitable for printing books which are sold in millions of copies throughout the Soviet Union.

We had a magnificent view of Polyudov Kamen (Cliff), the second most interesting sight of Krasno-



The Vishera

vishersk. Crowning a high hill dominating the area, Polyudov Kamen is a huge monolith one side of which is steep while the other slopes gently and resembles the backbone of a prehistoric monster.

For many years now Polyudov Kamen has been the site of a weather station with a permanent staff

of specialists. But even without the station the cliff is a weather forecaster. Whenever its summit is lost in a haze or wears a cloud cap the weather is bound to deteriorate; but when its contours are clearly seen, though at the moment it might be raining, the weather will definitely improve.

The cliff has been made the subject of many legends. According to some it was the home of the robber Polyud, a man of extraordinary strength, who buried his loot in the hillside.

It was a pity that the *Mayakovsky* could not sail further upstream and we were unable to see the most picturesque part of the river, which above Krasnovishersk is deep enough for boats only.

The Vishera is just as beautiful as the Chusovaya. It has the same dashing rapids, the same cliffs standing as motionless sentinels along its banks. The best known are the Pisany (Painted) and Govorlivy (Talkative) cliffs.

The first is so called because ancient drawings of people and birds, which scientists believe had marked a boundary between the territories of two tribes, were found on it.

As regards the second cliff, it is also appropriately named. If you sing a song it will repeat it to the last note. And it will magnify a thousand times over an almost inaudible whisper.

... At three in the afternoon the *Mayakovsky* started out on the return trip.

Slowly, very slowly, it moved away from the pier, turned in an arc and once again the incessant change of scenery began. Krasnovishersk disappeared in the distance and only the slap-slap of the ship's paddlewheels broke the silence hanging over the river, awakening from their tranquil slumber its forests which were far more beautiful in their autumn garb than in their summer greenery.

Cherdyn.—Ilya Lunegov.—Floating memorial

Ten in the evening. The *Mayakovsky* had tied up at Ryabinino. It was dark night. The moon peeped out and then disappeared. Black water lapped at the ship's side and lights dotted the bank. The greyish silhouette of another passenger ship loomed at the pier.

A group of passengers boarded the *Mayakovsky*. A man wearing round, horn-rimmed glasses, a soft felt hat and a heavy overcoat, its collar raised, attracted my attention. He walked very carefully as though afraid of dropping a large fibreboard suitcase which he carried before him. Once on board he began to search for a place where it would be out of harm's way. He fussed so much that people began looking at him.

Cherdyn is a mere seven or eight kilometres from Ryabinino. I was disappointed that darkness prevented me from seeing the village of Ryabinino and the mouth of the Kolva, and even more so at being unable to go to Cherdyn which was such a short distance away.

Cherdyn is an ancient settlement on the Kama. It is impossible to say exactly when man first put up a dwelling here and lit a fire in the hearth. One thing is certain, however, it happened a long time ago. Russian chronicles first mention Cherdyn in 1472, and call it a town from 1535. Its importance grew as it handled more and more trade with Scandinavia and Novgorod. It stood at the crossing of trade routes. The tributaries of the upper Kama flow close to the tributaries of the Pechora which empties into the Arctic Ocean and of the Northern Dvina which flows into the White Sea. Cherdyn merchants loaded their boats with wheat and salt and returned with fish, pelts and other bartered goods.

Cherdyn was the focal point of a vast territory, the capital of Perm Velikaya. Later it became a fortified residence of Moscow princes. Still standing are the remains of an earthen wall which surrounded it, a wooden kremlin and an underground passage. To this day people discover on its outskirts and sometimes even in Cherdyn itself rusted pole-axes, battle axes, arquebuses, spearheads and swords, mute witnesses of fierce battles.

As time went on the importance of Cherdyn declined and it became an out-of-the-way provincial town of the Russian Empire with wooden houses, wooden churches and wooden sidewalks. Such has been the past history of the town. It is traced in the local museum which has a collection of all the finds connected with the town's past. The museum was organised by its first director Ilya Lunegov.

It was solely thanks to his efforts that a museum of history and local lore was opened in the town, and today he is known to both young and old for hundreds of kilometres around. Hunters and prospectors always bring their finds to him.

Incidentally, Lunegov is a hunter, too, and spends the hunting season in the taiga. Being an expert taxidermist he personally made all the exhibits in the Local Birds and Animals Section.

But his prime concern was to show as fully as possible the history of the establishment of Soviet power in this remote part of the Urals. Once he heard that one of the old-timers had an extremely rare thing in his possession, a handwritten journal dating back to 1917 compiled by members of the Red Guard. It took a man like Lunegov to persuade its owner to let the museum put it on display.

Another interesting exhibit is a memorial medal dating back to the first post-revolution years. It was

handed over to the museum by the relatives of A. Y. Neuimin, one of the first members of the Cherdyn Soviet of Workers' and Soldiers' Deputies. One side of this bronze medal depicts a worker and a peasant marching shoulder to shoulder with a torch in their hands, and on the other there is a five-pointed star with a plough and a hammer in the centre and the date: "November 7, 1918". Inscribed on the rim are the words: "Comrades! Let the world know about socialism."

We went on deck. The autumn night was so dark that we could only see the lights on the river bank and the lighted *Pamyat Okulova* (In Memory of Okulov) tied up next to the *Mayakovsky*.

This name brought back memories of the heroic period in 1918 when armed detachments of the young Soviet republic operating in the north of the former Cherdyn Uyezd fought against the Whites and foreign interventionists who had landed at Arkhangelsk. They failed to throw a noose around the Soviet republic from the north because men like Okulov defended the gains of the revolution.

A hero of the Civil War, like Captain Pirozhkov, Stepan Okulov was a Baltic sailor whom the Party had sent to the Urals. He distinguished himself in action against Kolchak. Okulov commanded an armed detachment of Chyormoz workers and, according to his associates, was a brilliant orator who knew how to make the masses follow him. When he lost the use of his legs he ordered his men to carry him so that he could speak to the people. He fought to the last. His descendants are presently residing in Perm.

People are mortal, but heroes who have earned the eternal gratitude of the people do not die. Stepan Okulov is no longer alive but the memorial to this fighter who gave his life for the greatest of all causes,

the happiness of the people, plies the wide expanses of the Kama.

Another memorial which sails on the Kama is the *Captain Pirozhkov*.

And what about our *Mayakovsky*, is it not a memorial to the poet whose fiery verses hit hard at the enemy?

**What was in the archaeologist's suitcase.—
From the depths of the centuries.—
Legendary Biarmaland**

I have already said that one of the passengers who boarded the *Mayakovsky* at Ryabinino attracted my attention because of the way he fussed over his suitcase.

This morning he came up to me in the lounge.

"Pardon my curiosity, but won't you show me the book you're reading?"

It was *Baurjed's Journey*.

"How very interesting," he exclaimed. "Judging by the cover design it's about ancient Egypt."

"Yes, it's a narrative about the first voyage of Egyptian seamen along the eastern coast of Africa."

"Of course. I should have known. Won't you let me glance through it?"

I hesitated and he hastened to apologise. "You're reading it yourself. You must forgive me." Yet, he did not seem inclined to return the book. "You know, I could show you something interesting, perhaps even more interesting. What I am talking about is much more interesting than this book."

He bent down to me and lowering his voice as though in confidence said: "Do you want to see it?"

I nodded, though I had not the slightest notion of what he was talking about.

"Good. But in return you'll let me read your book. As a specialist I'm interested in it ... that's if you don't mind."

I had no option but to produce a polite smile.

"As regards the thing I'm going to show you," he continued, "for the time being ... it's not a secret, on the contrary, it'll be made public ... but still, for the time being..."

I nodded again. I was beginning to get interested.

"I shan't be a minute. I'll just finish my cocoa and we'll go."

"Where?"

"To my cabin, of course. I've got it there."

"In the suitcase?" I asked mechanically, recalling how carefully he handled it.

"Yes. But how do you know?" he said with a note of suspicion looking at me over the rims of his glasses.

"Well, I really don't know. It's just that I saw you with the suitcase."

"Ah."

He gulped down his cocoa, and a minute later we were in his cabin.

Showing me in he made sure that the door was closed. Taking down the suitcase he put it on the bunk and opened it with a key. There was a paper package in it and my new acquaintance began unwrapping it with infinite care. Besides paper the "thing" was wrapped in gauze and swathed in cotton wool. My impatience mounted. He took off the gauze and paused with a probing look at me. His eyes had a victorious gleam. I could see that he was proud about something, and tensed in anticipation of what was to come. He peeled off the cotton wool and my eyes caught the tarnished gleam of a whitish metal. It was a chased bowl shaped like a boat and the size of a large eggplant. Holding it as carefully as he

would a new-born baby he brought it close to my eyes. One side of the bowl had a large dent and the other was deeply scratched. There was an interesting etching extending along its entire length like an ornament: horsemen on light-limbed steeds spearing lionlike animals with predaciously yawning jaws. The drawing and the bowl itself had an air of deep antiquity.

Seeing that I was not too impressed, he sighed and the enthusiasm in his eyes faded. "What a pity you aren't an archaeologist. Don't say anything, I can see that."

Since ancient times silver and sometimes gold utensils of exquisite workmanship—dishes, bowls, goblets—with etchings depicting fantastic hunting scenes, religious rites, and scenes of everyday life have been found in the fields and forests in various parts of the Kama area. It has been ascertained that these utensils were not of local origin and in their overwhelming majority were made during the Sassanid dynasty of Persian kings who reigned from the third to the middle of the seventh century A.D. But why were they found in the Kama area? Shedding light on the ancient history of the territory these discoveries show that even in those times the peoples living along the Kama traded with other countries and that the Kama was already a convenient and reliable trade route. Many Scandinavian sagas of the 9th-13th centuries mention the existence of Biarmaland, a fabulously rich country lying far to the east among impassable forest. It cannot be said exactly where the boundaries of Biarmaland passed, but probably it extended far to the north, perhaps even to the Arctic Ocean since the Biarmalanders, among other items traded in walrus and mammoth tusks.

The Kama area's old trade ties with foreign countries enriched Soviet museums with rare samples of

eastern art, which together with other archacological and historical data have made it possible to obtain an idea of the life in this vast territory, beginning from the most ancient times.

Trade was carried on with Iran (Persia) and Byzantium. The route to Perm territory passed along the Khvalyn (Caspian) Sea, through the capital of the Khazar Kaghanate situated in the mouth of the Volga, across the land of the Burtasians and through the Kama-Volga kingdom of the Bulgars. There is reason to believe that these ties extended to India. Thus, in 1888 a silver dish of antique workmanship was found near Perm. The dish greatly resembled another one which though found in Central Asia was made near Jalalabad. The similarity shows that the dish discovered on the banks of the Kama was of Indian origin. An Indian bowl was also found in Sludka.

The bowl which I was holding could have easily performed a voyage no less exciting than that made by an Egyptian by name of Baurjed who explored the eastern coast of Africa. If unwound the invisible thread connecting it with antiquity could raise the veil enshrouding the past. And one could understand the archaeologist who made no effort to conceal his joy and pride in possessing such a treasure.

He told me how he got hold of the cup.

"The Kama is of exceptional interest to us, archaeologists. Yes, exceptional is the word. Just imagine, all the things that we find on the banks of the Kama, are almost never found anywhere else. Even where they had been originally made. The past upheavals, the succession of ruling dynasties, wars, and the collapse and destruction of entire states had wiped out the traces of material culture of many historical periods. That's, for example, what happened to the re-



Ancient Persian dishes are frequently discovered
in the Kama area

mains of the Sassanid epoch which embraces several centuries in the history of Iran. Almost no remains of it have been found there, in Iran. But they have been discovered here, on the Kama. By studying them we can retrace not only the history of the Kama area, of our country, for that matter, but also the history of other countries, Iran included."

Carried away by the topic, he continued as though lecturing in a university hall.

"...The Kama and the Volga are in effect a waterway whose role in the development of human society can be matched only by a few other rivers. The Danube and the Yangtze, that's about all. That's why we called Volga mother. And without the Kama, the Volga would have not been the Volga it is. In effect the Volga with the Kama accounted for the bulk of the trade between Muscovy and the eastern countries."

"But what about the bowl?" I reminded him.

"Ah, yes ... the bowl. Each year our university—I'm on the research staff of Perm University—fits out archaeological expeditions to the Kama basin. We

choose a site and live in tents until autumn. Usually we discover much that is valuable for science.... What? No, I didn't find the bowl. I had just returned for the opening of the semester when a cable arrived from Cherdyn. I suppose you've heard about Lunegov. Well, he sent it. A fine person, with an excellent knowledge of the territory. He built up the museum virtually on his own, and even made the people there interested in archaeology. Well, the cable said that they had found the cup and wanted someone from the university to fetch it. As luck would have it there was no one we could send. All were away. In the past two years we have been sending archaeological expeditions to the area of the future Kama Sea. There we found encampments of the Paleolithic man. In just the Glyadenovskoye Kostishche, near Perm, we made a large number of valuable finds, including bones, some well-preserved household utensils and tools. And there is still much to be discovered. While the area hasn't been completely flooded we have to continue our excavations.... So I went myself. It was a worthwhile trip, indeed. A splendid piece of work."

He cast an approving glance at the bowl and took it gently from my hands.

"They were ploughing a new field and the blade plucked it out of the ground. See the dents on it? Now it will be placed on display either at the Museum of History or at the Leningrad Hermitage."

Wrapping up the find as carefully as though it were made of crystal, he added with a smile:

"That's the end of our trip into the remote past.... I do hope you'll let me have the book. I promise I'll be through with it before we arrive at Perm. You know, curiosity is an incurable sin. I do hope you'll forgive me."

During the rest of the day my thoughts hovered over the archaeologist's narrative and the bowl that was hidden in his suitcase. Greatly stimulated by contact with the past I imagined that it was not 1953 and not the Kama along which our *Mayakovsky* was sailing, but a totally different river. I heard the war-cries of the Biarmalanders, visualised boats with warriors swooping out of ambush to attack caravans of merchant vessels, red-bearded Persians in bustling market-places trading gold- and silverware for the skins of white bears and polar foxes. I saw Novgorod merchants on their sharp-bowed boats courageously sailing deeper and deeper into the forests. I heard their songs and the clashing of swords.... Life changes. New towns arise on the charred ruins of old ones; but the river flows on and the wind rakes its surface raising foam-crested waves.

**Pozhva, town
of the first Russian steamships.—
Last glance at the river**

There was a storm on the Kama on the last day of our journey. Dancing along the entire width of the river mane-tossing waves slapped heavily against the ship's hull. The wind whistled scattering raindrops and chasing the low clouds.

We had just passed Berezniki. The level of the Kama had risen and the *Mayakovsky* forged confidently ahead, sailing over the rapids which handicap navigation during the dry season.

We passed another interesting place on the Kama, Pozhva, a town whose name is associated with a major achievement of Russian engineering thought. Russia's first steamships were built here in the beginning of the last century. Officially they were built by

Vsevolzhsky, the owner of the shipyards, but the man who actually designed them and supervised their construction was engineer P. G. Sobolevsky.

Two ships were built, one had a thirty-six hp, the other a six hp engine. They were built in 1815 (though Semyonov-Tien-Shansky puts the year as 1817). In the summer they made their successful maiden voyage to Kazan and their builders had every reason to be jubilant. In effect this year is regarded as the beginning of steamship river navigation in the country.

In 1821 Russia's first tugboat was built in Pozhva. It was used for towing cargo barges.

Incidentally, in 1839 the first locomotive for the Tsarskoselskaya Railway, Russia's first railway (not counting the Viysk line constructed in Demidov's Nizhny Tagil District), was also built in Pozhva.

Our voyage was coming to an end. Waking up early the following morning, we packed our bags and spent the last hours to Perm on deck.

It was time to say good-bye to the river. In the greyish light of the new day we reached the point from where we set out on our trip, the construction site of the Kama Hydroelectric Station.

A vast panorama of construction work unfolded before us. Both banks of the Kama seemed to have been cut up by a gigantic plough. Excavators, bulldozers and dump-lorries moved between huge mounds of earth, and an endless line of carriers suspended from a cable sailed overhead. The air was filled with the clang of metal and blare of horns.

A large township of two- and three-storey stone houses had mushroomed on the elevated right bank. On the left bank, where the lock was being built and where almost nothing remained of the original relief, it was still difficult to discern the contours of the future canals, but the scope and scale of work was

perhaps even more impressive than the concrete dam and hydroelectric station, which seemed to be rising straight from the depth of the Kama waters.

Once again we entered the narrow channel between the construction dams. The fast current carried the *Mayakovsky* as if she were a boat sailing down a mountain stream. Emerging from the channel we sighted the white stone building of the Perm river port and the city itself. It had been a splendid voyage and we were sorry that it had come to an end.

We were just about the last group to have made a through journey along the upper Kama from Perm to Krasnovishersk and back, when it still flowed freely from its headwaters to its mouth. No one will ever see *that* Kama again.

The weather was fickle, it rained and snowed and the sun preferred to hide most of the time. Nevertheless, it was a wonderful experience.

We cast a farewell glance at the river. Good-bye, old Kama. Hello, big Kama, transformed, carrying its waters along a new bed, wide and deep as the sea.

**The Kama today.—The Kama Sea.—
Oil islands.—Legend about the golden idol.—
A look into the future**

To grasp the enormous significance of the changes that have taken place on the Kama it is necessary to be in Perm in the spring, in the high-water season.

Spring on the Kama. . . . With the coming of sunshine and balmy winds we, then students, would not miss a day without going to the Kama. After lectures we would run to the bank to the spot where Karl Marx Street terminates at the landing for suburban

passenger launches. There, from an elevated platform, worn smooth by thousands of feet, a favourite spot with the inhabitants of old Perm, we gazed at the river rolling its waters, with a dark line of forest on the horizon and the deep blue sky above. We used to stand there hours on end watching the ice run which lasted a long time, usually seven or ten days. And it seemed to us that even the sparrows chirruped the great news that the ice on the Kama had broken.

Year in and year out people flocked to the river bank to see spring's triumphant march.

And suddenly they were deprived of the sight.

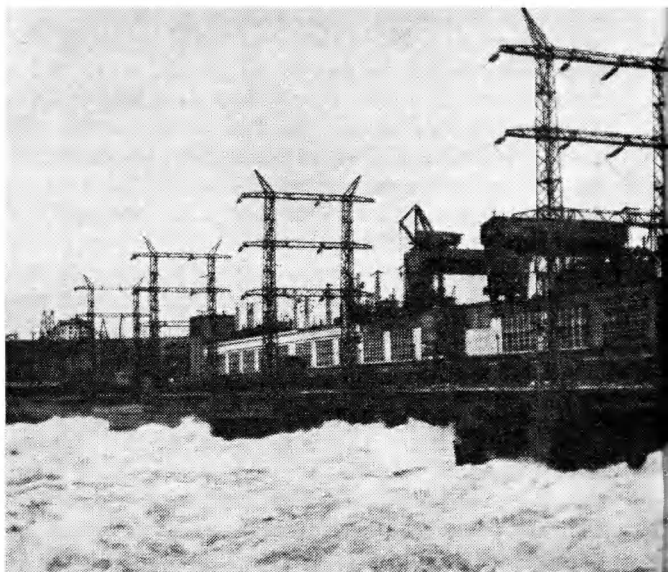
The spring of 1954 was unlike any other spring. In vain did the townsfolk wait for the ice run and high water. Under the warm rays of the sun the river's shell of ice disappeared gradually, I would say, even surreptitiously, and navigation commenced. This happened the first spring after the Kama was blocked. All the ice beyond the dam remained in the man-made sea where it melted away. That happens every spring now and the river always flows placidly at Perm.

Today passenger launches sail up the Chusovaya. Lyovshino now has a large port built by the builders of the giant hydroelectric station on the Kama. What is most important, however, is that there has been a sharp increase in the supply of electricity not only for Perm and its environs, but also for industrial enterprises, workers' townships and collective farms situated far from the Kama.

All those who come to Perm make a point of visiting the electric heart of the Kama area.

Following their example we boarded a small fast passenger launch which took us to the Gaiva landing.

Gaiva was the name of the village where the Kama Hydroelectric Station now stands.

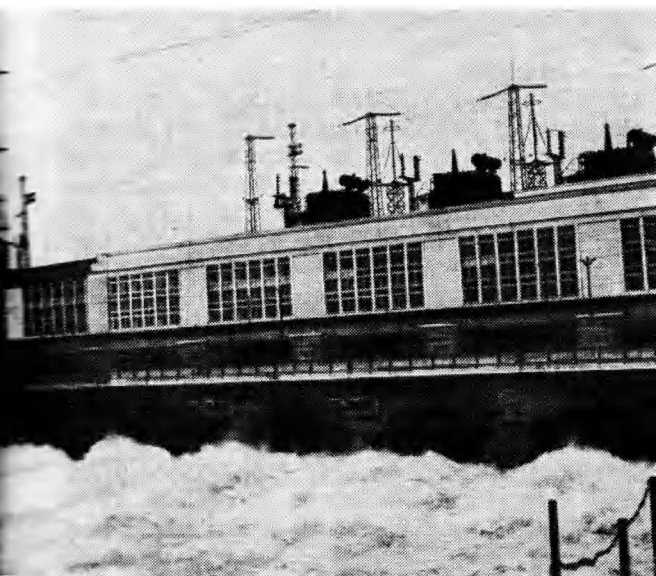


The Kama Hydroelectric Station

The place has changed beyond recognition. There is no trace of the channel through which the *Mayakovsky* sailed on her last trip from Krasnovishersk. The river is spanned by a dam which reliably holds back the newly-made Kama Sea.

The sea was invisible from the river. But it was there and its waters were bursting through the dam's concrete sluices raising clouds of water dust and booming like a cannon. The sea was no longer a dream but a reality like the hydroelectric station whose turbines it turned.

The Kama station is of original design: it is entirely hidden in the body of the dam. Below are machines and above a many-metre layer of water flows



incessantly from the head race to the afterbay. The building, if one can call it such, extends half-way across the river (here the Kama is 800 metres wide and the length of the building is 400 metres), and is not on the bank as has long been customary in hydroelectric station construction.

For a period the Kama station was the only one of its kind and some people were even inclined to think that it would remain unique. But they were wrong. Subsequently similar hydroelectric stations (though with certain modifications) were built on the Angara and other rivers.

The Kama station was the first major hydroelectric scheme in the Urals and its construction was impatiently awaited not only here, in the Kama area, but also far to the east of the Ural Range, since its purpose

was to augment the supply of electricity to the entire Urals area.

The inexpensive Kama electricity considerably improved the situation of such power-intensive parts of the Urals as Sverdlovsk and Sverdlovsk Region. High-tension transmission lines crossed the Ural Mountains bringing electricity to the mines on the eastern slopes. Later, through the Southern Urals Power Grid, Kama electricity merged with the Volga electricity generated at the Lenin Kuibyshev Hydroelectric Station to complete the creation of a huge power grid.

Not a single responsible official went to bed on the night preceding the commissioning of the station. I was there, too. Late in the evening the construction chief, the chief engineer, the Secretary of the Party organisation, engineers on duty and work superintendents gathered at the first turbine. There was a feeling of elation at the thought that the Kama Hydroelectric Station, born of the efforts of thousands of people, would shortly begin generating electricity in immense quantities.

At the same time all were a bit worried: will things go off well?

The turbine was idling, filling the concrete premises panelled with gleaming tiles with its sonorous hum.

The last check-up of all the electric devices and apparatuses took up the whole night.

Dawn, September 18, 1954 (exactly a year had passed since the voyage on the *Mayakovsky*). The last preparations had been completed.

Finally the great moment arrived. As a rule the commissioning of a hydroelectric station is conducted with pomp and circumstance: a high official cuts a ribbon, lights go on and everybody cheers. This time it was different, and were it not for the indicators

on the various apparatuses no one would have thought that the first hydrogenerator of the Kama Station had begun producing electricity that flowed from the Kama to all parts of the vast territory.

At ten in the morning, or, to be precise, at 9.59 Urals time, according to the chief engineer's chronometer, on September 18, 1954, the hydropower giant on the Kama became yet another operating enterprise of the Soviet Union.

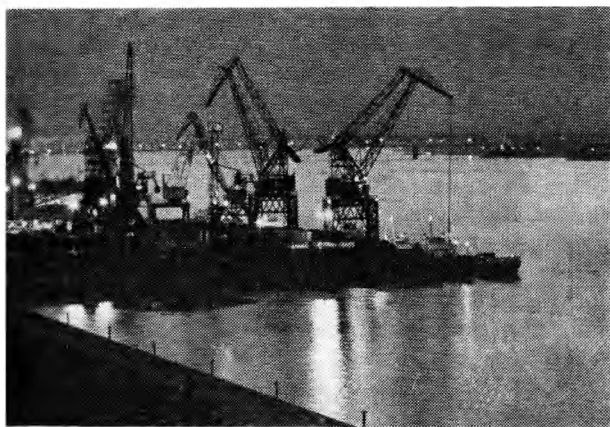
The atmosphere was businesslike. There were no florid speeches. Having assured themselves that everything was functioning normally the engineers breakfasted and then disregarding the sleepless night departed to the construction site where there was work to be done.

Yet, a feeling of joy and pride persisted in all those who were on the Kama that night.

A new, electric Kama was born. And it was this transformed Kama I saw in the vast expanses of the Kama Sea. . . .

From a vantage point on the earth dam I had an excellent view of the sea. Its distant shores were half-hidden in the haze. A gentle breeze ruffled its surface and caravans of billowy clouds sailed overhead. A sheer cliff on the bank of the Chusovaya became a wooded cape which ships have to round. The old village of Lyovshino has disappeared underwater and its inhabitants now live in Novoye Lyovshino built on an elevated portion of the land. It was necessary to move the railway, and a beautiful new bridge on high supports now spans the Chusovaya.

Two straight canals, two threads of the navigable sluiceway with twelve locks, gash the artificial relief on the left bank. The walls of the sluiceway are dressed in iron and concrete and the locks are large enough to hold a flotilla of medium-size ships or a large timber raft. The Kama sluiceway was designed



Cranes in the Perm Port

to meet the requirements of timber rafting, hence its colossal size.

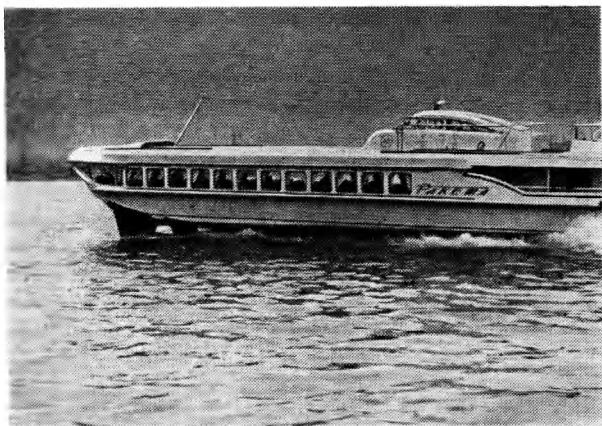
Leaning over the railing, I watched several motor launches tugging a string of boats enter the lock followed by another tug. The last to enter the lock was a sporting yacht which immediately lowered its triangular sail.

The gates closed with a rumble. Water rushed into the lock. The vessels rose higher and higher and the yacht's mast appeared right in front of me, close to the wall.

"Don't you recognise me?"

Bewildered, I stared at a hatless sunburnt man in a striped T-shirt and canvas trousers who was waving to me from the yacht. There was something faintly familiar about him, but because of the huge sunglasses which hid half his face I could not recognise him.

"Can't place me, eh? Looks as though my memory



The *Raketa* hydrofoil on the Kama Sea

is better than yours. Remember the autumn of 1953 ... the *Mayakovsky* and the Persian bowl, the one I showed you...."

He pulled off his goggles. Of course it was the archaeologist. Who could have imagined that he was also a yachtsman?

Holding the mast he leaned towards me and we shook hands over the yellow Kama water.

"Where are you heading for?"

"Just a short cruise on the Kama Sea. Maybe you'll join me. I'm all alone and there's plenty of room on the yacht."

He seemed to have been reading my thoughts, for that was just what I was dreaming about as I stood there admiring the view.

"Jump in. It's easy." He held out an assisting hand.

"Hey, you're not supposed to do that," a voice cried out. But I was already on the yacht and the

guard, a young girl in red kerchief and rubber boots, could do no more than scold me.

While the yacht passed through all the six locks which raised it to the level of the sea we talked about the trip on the *Mayakovsky* punctuating our conversation with exclamations about the changes that had taken place on the Kama.

The Kama Sea is three hundred kilometres long and it took almost three floods to fill it up to the planned level. In fact its level was raised even higher in order to have a reserve of water for the turbines. The very first year the sea wrought considerable changes in the life of the river, in places transforming the geography and economy of its banks.

The new sea created serious difficulties for raftsmen and captains of raft-towing tugs. Even captains of ordinary cargo ships went through a period of training before they were allowed to sail on the Kama Sea. The sea put their endurance and nerves to a rigorous test.

I should like to say a few words about the imperturbable and somewhat caustic Captain Shirinkin. This specialist in guiding huge rafts studied a lot of special literature to determine the size of the rafts which could be towed on the sea. Taking careful stock of everything, he decided that it would be safe to tow a raft of 22,000 cubic metres, almost twice the size which the shipping line considered possible, and did so successfully. The next time he guided a raft of 32,000 cubic metres. The attempt almost ended in disaster, similar to the one which overtook him in the mouth of the Kama. A storm broke out and the raft began to rock. All raftsmen were on the lookout for a break in the fastenings. As luck would have it one segment of the raft did break loose and began to drift away. It should be borne in mind that just one weak link can spell disaster for the entire

raft. Two raftsmen, two brave lads, dived into the icy water and together with the men on the raft fastened the segment to the main body of the raft.

There were other occasions when the wind almost wrecked the rafts he towed. Once it drove a raft towards sheer limestone cliffs on the bank. There was nothing the tug could do, and nothing came of the attempt to save the situation by throwing the ballast of iron into the river. But skill plus courage and sober thinking won the unequal battle. Captain Shirinkin steered the tug towards the opposite bank slowly pulling the giant raft away from the dangerous cliffs.

In addition to a thorough knowledge of the speed of the current, the zigzags of the fairway and its seasonal changes, it was now essential to know the direction of the winds and the waves and where to seek refuge from a storm.

Captains such as Shirinkin (there are many of his kind on the Kama) managed to overcome all difficulties in the course of the first navigation on the Kama Sea. Today Captain Shirinkin commands a powerful tugboat, the *Geroi Lobanov*, one of many that guide huge cigar-shaped rafts to the Caspian Sea.

"But where are we going after all?" I asked.

"Well, I've long been wanting to go to Polazna, the place where they mine for oil. It's a lovely spot and well worth seeing. Have you heard about the iron isles of the Kama? They're over there. What about taking a look at them, eh? I'm on leave and there's plenty of food on the yacht."

I agreed.

Incidentally, he was also studying the Kama Sea. He told me some interesting details about the new water regime of the Kama. Among other things he

informed me that the winds were now very frequent on the river, that the velocity of the waves was sometimes as great as 30 kilometres per hour, that the final contours of the sea are still being shaped and that since the shoreline will continue changing for a long time it was still too early to chart detailed maps.

We were sailing close to a steep bank. Pines were perched on its top, or rather they hung from its top by their roots. The face of the cliff was cracked. I wanted to see the cliff at a closer range but he shook his head and said: "That'll be dangerous."

I wanted to know why, but before he could reply there was a rustling sound and stones began to roll down the cliff. They were followed by a compact mass of earth and rock which broke away from the shore and with a terrific roar collapsed together with the pines. There was a heavy splash as it disappeared in the water. The trees floated to the surface and spun around for a long time.

"Now you know," said the archaeologist.

The shores of the Kama Sea consist mainly of sedimentary rock which is easily eroded. In this case the water was responsible and we were able to see how the coastline changed its configuration under the impact of the waves.

"Worse things than this have happened," continued my companion. "Three years ago after a storm the coast at Sludka collapsed sinking two launches. They were raised to the surface. And, just imagine, an entire lunchroom—luckily there was no one in it—slid into the water at Bor-Lenva. Divers regularly check the foundation of the dam at the Kama Station, but it's impossible to check the state of the entire coastline."

The sun had set and to keep away the chill I put on a jacket offered by my companion.

A dark long object with fires burning on it came into sight. It seemed to be motionless and did not resemble a raft. There were bushes on it.

"It's one of those patches of peat bog that float up to the surface," explained the archaeologist. "They were particularly numerous during the first year. Once an island with a birch and alder grove floated up to Polazna. A chunk of floating land good enough to build houses on. Well, not houses, of course, but good enough to fish from, and keep your feet dry at the same time."

We sailed so close to the "chunk of floating land" that our sail almost brushed the bushes sheltering the anglers who had made themselves comfortable next to merrily burning fires.

Some of these floating islands are very large: hundreds of metres in length and dozens in width and two-three metres thick. In 1956 an island 4,000 metres long and 800 metres wide floated up in the vicinity of Verkhny Lukh. Driven by the wind and the current these islands drift in the sea until a storm breaks them up.

A hand touched my shoulder. "Wake up, man, or you'll miss the beauty of it."

The sun was rising. A thin mist lent a ghostly outline to the coast. Everything around was azure, and the water was like a tarnished mirror. In this blue light we saw an approaching passenger ship. Pinkish in the rays of the rising sun, it was a real beauty with its windows flaming like molten metal. Fires emitting columns of black smoke burned on the coast near a scattered group of houses. Opposite them, right out of the river rose the lacework of derricks under whose shadow seasoning pumping jacks sucked oil from the bed of the Kama. This was Polazna.

The northernmost point of the "Second Baku", the

Polazna oilfields, were flooded when the Kama Sea was formed. But a way was found of saving them. The oil workers added pipes to the wells, surrounded the derricks with steel walls and filled these huge boxes with earth forming artificial islands. Pipes laid along the bottom of the sea transported oil to the shore. Now Polazna oil is extracted from the bottom of the sea.

To lighten labour, it is planned to automate many processes. The pumping of oil from the wells will be remote-controlled from the shore and then people will no longer have to brave stormy weather to reach the iron islands.

By now it was time to return. As it once happened on the *Mayakovsky* our conversation again turned to the subject of archaeological excavations in the area of the Kama and the Kama Sea.

The archaeologist told me that thanks to the funds that had been allocated under the Kama Hydroelectric Project it was possible to conduct extensive research into the history of the Kama area.

Since then many interesting finds were made compared with which the silver bowl in which the archaeologist had taken such great pride was a mere drop. For example, in the mouth of the Chusovaya, in the vicinity of the Ostrov village, archaeologists studied the remains of a prehistoric encampment. They found charred bones which enabled them to obtain an idea of the animals which lived at the time and which served the prehistoric hunters as food. These animals were the northern deer, the mammoth, the woolly rhinoceros and the wild horse. The stone and bone tools discovered there were not less than 25-30 thousand years old.

Archaeologists first surveyed Orel-Gorodok in 1934. At the time they did not conduct excavations. This was done now and the results were encouraging.

They discovered coins dating back to the reign of Ivan the Terrible, old Russian utensils and weapons. Of particular value were watering vessels. Worked with rare artistry, they were decorated with battle scenes. Excavations also brought to light the foundations of towers built when Orel-Gorodok was called Koregedan and was an important fortified post.

Very interesting are the old ties between the Kama area and Central and Eastern Europe. Numerous relics of material culture discovered in the Kama area, particularly the drawings on the cliffs along the river banks, show that the Ugrians, the forefathers of the present-day Hungarians, had once lived in the Urals. Joint studies being conducted by Soviet and Hungarian scientists will clear up this question once and for all, and may also help discover traces of the legendary Biarmaland.

"Have you heard the legend about the Golden Idol?" the archaeologist asked.

I replied in the negative and this is what I heard from him.

"It is an ancient legend and no one knows when it first appeared. Neither is it known who made the golden statue of a woman regarded as a deity by the tribes that had once lived in the north and the north-east of Russia.

"What is known is that at the close of the 13th century the statue stood in a forest on the banks of the Kama where it was worshipped by the people of Vyatka and Perm. But even then not a single ordinary mortal had seen it. It was hidden in the densest part of the forest from where dismal moans would be heard at times. Perhaps they were emitted by ritual horns which, like the Aeolian harp, responded to the movement of the air. Only priests in red garments decorated with precious talismans were allowed

to see the goddess. They collected all the gifts and offers which people left at the edge of the holy forest.

"Then, for some unknown reason (perhaps because Russians began settling in the area and the priests decided to move the statue to a safer place), the goddess appeared on the other side of the Urals. For some time, according to Vogul witchdoctors, it was hidden in a cave near Denezhkin Cliff, and then was moved closer to the Irtysh.

"Once Yermak's men tried to steal the idol but the priests carried it away. Time passed and the idol appeared farther north on the Kazym River. After that it was seen on the Tazov spit on the Ob from where it was taken to the Taimyr Peninsula, and there in the Putoran Mountains it disappeared completely.

"Miniature silver copies of the golden woman were found in the last century. Today its whereabouts are unknown. Perhaps it is hidden in a remote cave, and those who knew where it was died, taking the secret into the grave with them.

"But let us change the subject and see what the future holds out, all the more so since the object of any study of the past is to lift the edge of the shroud concealing the future which is being born right before our eyes."

"It's just the beginning," said my companion leaning back in his seat and gazing meditatively into the distance. A gust of wind ruffled his hair and rolled the yacht. "I hope to see the time when ships from far-off Vychegda, Northern Dvina and from the White Sea will be sailing on the Kama Sea. You'll recall my words one day. I am not dreaming of the impossible. Even our forebears thought about a waterway to the Arctic Ocean via the Volga and the Kama.

"We are living at a time when even the boldest

dreams are coming true. Isn't that so? You can't deny that. And I'm sure it won't be long before we'll be able to sail from Perm directly to Arkhangelsk on the White Sea where Lomonosov was born. Vorkuta coal and Ukhta oil will be transported at a low cost and the inhabitants of Naryan-Mar in the Far North will be able to make a through trip by boat to Sochi. Something to look forward to. And have you heard about the Kama-Irtysh waterway? A colossal project. The Chusovaya will link up with the Isset by means of a canal to be dug near Sverdlovsk. The length of the canal will be a mere thirty or forty kilometres. The Chusovaya is being deepened and so is the Isset where locks will be built. The Chusovaya belongs to the Kama system of rivers, while the Isset is part of the Ob-Irtysh system; as a result there will be a giant waterway which will begin at the Caspian Sea and, passing along the Volga, Kama, Chusovaya, Isset, Tobol, Irtysh, and Ob, will end at the Kara Sea. This route will connect the southern regions with the extreme north."

Once, in the early years of Soviet power, great Lenin drew up the GOELRO Plan, the plan for the electrification of Russia. The material embodiment of these ideas, which are being further developed by the Soviet people are the Kama Sea, and the general rejuvenation of the Kama. But that is only the beginning. The Votkinsk Station, the second giant hydroelectric project on the Kama, was already under construction and the town of Tchaikovsky had already been built. In 1960 the construction was launched of the 500,000 volt transmission line between the Votkinsk Hydroelectric Station and Sverdlovsk. The Kama cascade was coming into being.

I tried to visualise these giant hydroelectric stations and pictured the Kama as a stair whose steps were giant man-made ponds or rather seas, with water

flowing from step to step and turning the turbines of hydroelectric stations. Combined with storage lakes, such a cascade of hydroelectric stations makes for the fullest possible use of the river's resources and completely eliminates the danger of drought. When the cascade is completed, the river will be regulated, to use a technical term, making it possible to store and rationally distribute the flood waters.

I visualised modern ships plying the vast expanses of water and endless lines of locks which would lower or raise them.

... We were less than half-way to Perm when the wind suddenly died and the sails dropped listlessly. The yacht rocked gently on the swell.

The throbbing of an engine made us look back. A white launch was speeding to our assistance. She belonged to one of the institutes of the Urals Branch of the USSR Academy of Sciences and by a strange coincidence was also called the *Mayakovsky*. She took us in tow and the yacht sped forward like a bird.

My thoughts flowed peacefully to the rhythmic sound of the engine. It occurred to me that a chronicler of the present-day Urals would hardly be able to keep up with its tempo of life. But what of it? After all, what I actually wanted to do was to describe the Kama before and after the great changes that have taken place on it. Make a trip to its upper reaches, delight in its vast expanses and breathe deeply of the sweet air of the Kama Sea. You will see much that is interesting but you will never see the Kama which we had seen from the deck of the *Mayakovsky*.

Years will pass and perhaps a future traveller will read the diary of our trip on the *Mayakovsky* and will be surprised: was the Kama really like we had described it? And it is not at all improbable that you

will be able to find a description of the old Kama only from this book, from our voyage on the *Mayakovsky* made for the express purpose of describing the old Kama and its striking contrast with the new Kama, transformed by the labour of Soviet people.

These thoughts revolved in my mind the rest of the way, and when we were close to Perm I saw the *Mayakovsky*, just back from a voyage tied up at the pier.



Silver Wings



*(A narrative about
Urals aluminium, or
a true story about
Little Red Riding
Hood)*

We all know the tale about Little Red Riding Hood. In this chapter we shall tell you a true story about a Urals "Little Red Riding Hood" that helped destroy a wolf which was a thousand times more terrible than the one in the tale.

**On the Track of Old Discoveries.—
Little Red Riding Hood**

Impenetrable taiga alternating with impassable swamps; bitter winters with blizzards that in a single night bury log houses up to their roofs in snowdrifts; hot summers with myriads of gnats whose stinging bites make the elk seek refuge in rivers and lakes; forests alive with animals and birds; snow-capped mountain peaks towering majestically in their immobile beauty, pink in the rays of the rising sun they seem to be covered with molten gold at sunset. Such is the Northern Urals, an austere territory fabulously rich in iron, coal, copper, precious metals, furs and timber. Soviet geologists have added to its fame by discovering vast deposits of aluminium ore—bauxites.

Over 80 years ago visitors to the Paris Exhibition were attracted by a small bar of an unknown silvery metal. It was aluminium, the metal of the future, and the method of obtaining it was worked out by the French chemist Henri Étienne Sainte-Claire Deville.

At first aluminium was extremely expensive and was used only in making ornaments and some parts of instruments. But the era of aluminium was already dawning and soon people could no longer do without it.

Aluminium is much lighter than many other metals. Though very malleable and ductile it is extremely durable. It does not rust, resists oxidation and has good thermal and electrical conductivity, vying in this respect with silver and copper. It was only natural that possessing these outstanding qualities it attracted universal attention, and as technology developed so did its fame.

Though by their outstanding discoveries Russian scientists did much to introduce the new metal into industry, tsarist Russia did not have her own aluminium.

Large-scale production of aluminium was started in Russia only after the October Revolution when the first aluminium factories were built on the Volkhov and Dnieper rivers. But they could not satisfy the country's growing requirements. And so Soviet geologists began to search for domestic bauxite deposits.

The word bauxite derives from Les Baux, a village in the south of France. In the beginning of the 19th century, a famous chemist Pierre Berthier travelling through those parts saw chunks of blood-red clay rock. Analysing them he discovered that they contained over 60 per cent of alumina. The clay proved to be aluminium ore. Later bauxite deposits were found in many parts of the world.

The search for bauxites in Russia also has its history. Newspapers in 1882 reported the discovery of aluminium ore in the Tikhvin Uyezd. Unfortunately this report did not lead to any practical results at the time. The Tikhvin Alumina Factory was built only after the establishment of Soviet power.

At the time the search for Urals bauxites was conducted by the Industrial Committee. In 1928 the government assigned large funds to finance bauxite prospecting and in 1929-31 newly-discovered bauxite deposits, including the Sokolovskoye deposit of industrial importance, were marked on the geological map of the territory.

A major role in discovering Urals bauxites was played by Karzhavin, a geologist-pro prospector. He thoroughly explored a vast area in the vicinity of Serov, the Ivdel River and the top of Denezhkin Kamen.

Undaunted by months of fruitless efforts Karzhavin pursued his search for the elusive Urals bauxite, traces of which were in evidence here and there.

Once Karzhavin's party decided to inspect the abandoned Dansha Mine. Leaving behind the village of Petropavlovskoye, the former site of Russia's oldest copper works, the prospectors followed a slender path winding along the bank of the Vagran. Arriving late in the evening they pitched tents and on the following morning set to work.

The results surpassed all expectations. They found bauxite, real first-class bauxite. Extending due north, its layer was 5-6 and in places over 15 metres thick. Karzhavin was close to attaining the goal of his life.

Called Krasnaya Shapochka (Little Red Riding Hood), this slightly elevated, wild place overgrown with dense taiga was soon plotted on all geological maps.

The discovery of Little Red Riding Hood bauxites made it possible to build a number of aluminium factories, including the Urals Aluminium Plant. A powerful aluminium industry appeared in the country.

In 1944, N. A. Karzhavin was awarded the Order of the Red Banner of Labour. In 1946, he and a group of people who discovered and studied the

Little Red Riding Hood deposits were awarded the State Prize.

The Grim Year of 1941

The development of the Little Red Riding Hood deposits was launched in the beginning of the thirties. A new name, North Urals Bauxite Mines, was added to the list of Soviet industrial enterprises.

The northern climate is not too hospitable. It frequently snows in June and at the close of August the nights are so cold that a thin sheet of ringing ice covers the puddles. The summers are short and the building season is therefore short, too. Moreover, the builders worked in the taiga far from human habitation and roads.

The first pit called Kapitalnaya was sunk on the spot where Karzhavin took his first samples of rock. At a depth of 28 metres water began to gush with such force that no further work was possible, and for a long time the pit was merely used as a well.

When the Great Patriotic War broke out, only one pit, the Southern, was in operation and all the ore was delivered to the Urals Aluminium Plant.

To meet the requirements of the war-time industry an intensive search was launched for fresh sources of strategic raw materials. Bauxites were essential for the defence of the country which had clashed in mortal combat with nazism.

Russians, Ukrainians, Georgians, Kazakhs, Byelorussians and Maris, in fact, people from all corners of the country began arriving in the village of Petropavlovsky and the Southern Pit in the north of Sverdlovsk Region. Among them were builders of the Moscow underground, experienced in digging tunnels through water-saturated rock. A large group of skilled workers, engineers and technicians arriv-

ed from Urals copper mines. The area was studied by 500 prospectors of the North Urals Bauxite Geological Prospecting Expedition. Conditions dictated that further prospecting, the sinking of mines and extraction of ore be conducted simultaneously.

People worked in the silent, wary taiga. There was no railway and no electricity.

While the central electric power station designed to supply electricity to the North Urals Bauxite Mines was under construction, mines were being sunk on the territory of the deposit.

That year the winter was extremely rigorous. People pickaxed the hard frozen earth. They lit fires to keep themselves warm. It was backbreaking labour but they never complained because every bucket of bauxite was a blow at the enemy.

The State Defence Committee in Moscow sent cables encouraging the workers and demanding more, ever more bauxite. Knowing full well that their work was indispensable for the war effort, the miners pledged to increase the output of bauxite whatever it may cost them.

Karst caverns and aquifers impeded the construction of mines and the deeper they became the greater was the inflow of water. Disaster struck the builders of Pervaya-Bis pit when they passed the 100-metre level. Water rushed with such force that all work came to a standstill. The inflow was 1,700 cubic metres an hour. That meant that the water level in the shaft rose by two metres each minute. People barely managed to scramble to safety. All equipment was lost.

Rivers of water flowed in the eternal darkness of the subterranean layers. The water was as clear as crystal, but in the twilight of the drifts it appeared to be as black as ink.

The local people called it age-old water.

And indeed it had never seen the light of day, it had never emerged to the surface. For millions of years it flowed in the sombre depths cramped in rocky voids. Now, having an outlet from its stone prison, it gushed forth frightening in its fury and ferocity.

But neither difficulties nor privations made the miners flinch. With each passing day they produced more and more bauxite. There were less and less cables from factories and increasing numbers of freight trains with ore sped southward.

The turning point came in 1943. Towards the end of that year five pits were in operation. The railway had been extended to the most distant mines, the Cheremukhovsky Pit.

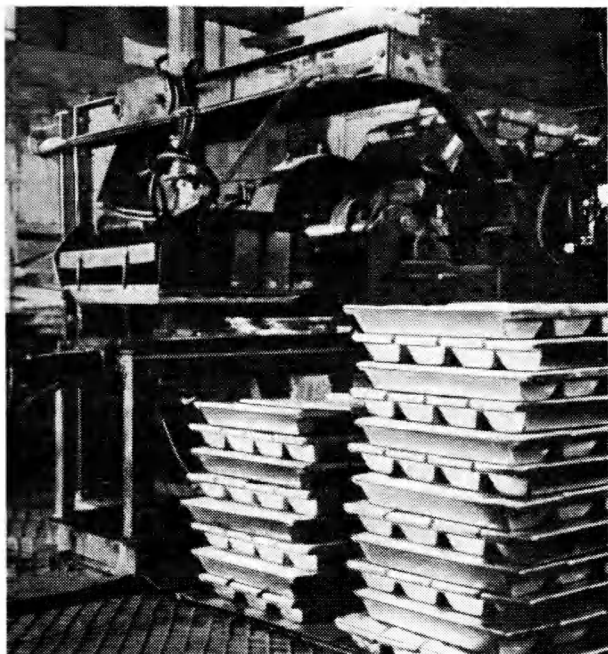
Two of them were open-face mines. Excavators removed the upper layer of the earth and laid bare the bauxite seam. Then the ore was blasted, loaded into dump-cars and delivered to the railway station.

Nothing could stop the people from fulfilling their pledge. They worked even when the thermometer dropped to -57°C , when everything was enveloped in fog and all things wore a prickly mantle of bluish hoarfrost, when neither animal nor bird was heard or seen and when metal became as brittle as glass.

The great battle for aluminium continued. It was a front on whose operations depended the success of the operations of another front thousands of kilometres away where cannon roared and blood flowed. That was how the Little Red Riding Hood of the Urals helped defeat the rabid nazi wolf.

The Urals Aluminium Plant

In keeping with the government decision of May 1932, the construction of the Urals Aluminium Plant



The hydrolysis shop of the Urals Aluminium Plant

was started in 1933 in Kamensk-Uralsk, one of the oldest industrial towns of the Urals.

On July 1, 1939, the first shop went into operation, and a few months earlier, on March 26 the Krasnogorsk Thermal Electric Power Station began generating electricity for industrial purposes.

At exactly 5.30 p.m., on September 5, 1939, the plant produced its first aluminium which was also the first aluminium ever made in the Urals.

Numerous guests arrived for the occasion. Scooping up the molten aluminium with a spoon a worker

cast souvenirs out, small bars with the inscription "UAZ (Urals Aluminium Plant-*Tr.*), September 5, 1939", which were presented to those present.

The following year the plant was already turning out aluminium of the highest quality.

The Battle for Aluminium

In the autumn of 1941 an endless chain of trains with people, materials and industrial equipment kept arriving at Kamensk-Uralsk. At the time such trains with people and factory equipment evacuated from the front-line areas were heading for all towns of the eastern regions of the country. Conditions were extremely difficult. There was a terrible shortage of housing. Two and sometimes even three families shared a single room. There were not enough premises where machine tools and other industrial equipment could be installed. But the situation in Kamensk-Uralsk transcended all bounds of imagination.

Within the first months following the outbreak of the war the frontline was already close to the Volkhov and Dnieper aluminium plants and they were urgently evacuated into the interior of the country. The Tikhvin Alumina Factory was put out of service.

As a result only the Urals Aluminium Plant remained in operation. But the war effort demanded enormous quantities of aluminium and not only because it was essential in aircraft production but also because not a single branch of industry could do without it.

And so trains with people and equipment, sometimes as many as several a day, began arriving at the Urals Aluminium Plant. The station could not cope with the influx of passengers and freight. All feeder lines were congested with mountains of ma-

chines and crates with equipment from the Dnieper and Volkhov plants.

It seemed that it would be absolutely impossible to do anything with this heap of equipment. Yet it was necessary in the shortest time imaginable to sort everything out, repair the equipment, install it and launch production.

Engineering difficulties, however, could not be compared with the difficulties connected with providing the new arrivals with food and housing. Within a very short period 30,000 people had arrived and the small town could not accommodate such an influx of evacuees.

The flow of people and equipment continued. Eleven locomotives worked round the clock shunting the 600 carriages that were unloaded daily. Builders, 35,000 of them, were transferred to the Urals Aluminium Plant from 12 construction sites. A building job unprecedented in scope and scale was launched.

All houses, every square metre of floor space was registered. The arrivals had to have a place where to live. But where? The builders designed a special type of wooden barracks and built them at the rate of one a day. In three months a township for 20,000 people was put up.

The new arrivals were accommodated in all villages within a radius of 10-15 kilometres from the town. Six trains made daily runs from the Bagaryak station to transport the workers.

Nevertheless all these measures were inadequate. Winter was just round the corner and thousands of people still had no roof over their heads. A huge encampment of workers buzzed around the plant. People lived in tents, dugouts, hastily built plywood houses, and cooked food on fires outside their homes.

In October 1941 tens of thousands of workers were

putting up the second section of the Urals Aluminium Plant and within 13 months they completed the construction of what in effect was a second Urals Aluminium Plant. It should be noted that the first section of the plant took almost seven years to build.

In those years the plant was the sole producer of aluminium, a strategic metal without which victory would have been impossible. On sixteen occasions it won the Challenge Red Banner of the State Defence Committee. And when the war ended the banner remained at the plant for good.

The Bogoslovsk Aluminium Plant

While the workers of the Urals Aluminium Plant increased the output of aluminium in unprecedentedly difficult war-time conditions and augmented production capacities at a fantastic rate and while the miners of the bauxite mines at the cost of heroic effort organised the extraction of bauxites, the construction of the Bogoslovsk Aluminium Plant north of the town of Serov in the direct proximity of the Little Red Riding Hood deposit was gathering momentum.

The plant was going up on the western environs of the Turyinskiye Rudniki mining township. A more convenient site could hardly be imagined. Right next door was the Little Red Riding Hood Pit, the newly-discovered Volchansk coal deposit and the older Bogoslovsk deposit, and vast quantities of timber. The Turya River would provide the plant with all the water it needed.

And again there were incredible difficulties and privations. At the time there was hardly another project that was going up in such rigorous climatic, geographic and economic conditions.

The first and the most urgent task was to provide the builders with food and housing.

But in order to create an agricultural base in the dense taiga it was necessary to fell trees, grub out the clearings and prepare the ground for sowing. People gathered berries and mushrooms in the taiga, hunted wildfowl and fished in the lakes. A large herd of cattle was brought here during the first war-time autumn and stocks of fodder were laid in for the animals.

Electricity was initially generated by small mobile power stations. After that a temporary power station was built and subsequently the construction of a large thermal power station was launched.

The organisation of a building materials base, the training of personnel and industrial construction were all conducted simultaneously.

Mosquitoes, the scourge of the Northern Urals, plagued the people forcing them to work in bee veils. Then winter struck but work continued. New methods were devised to keep the construction going without interruption. Crucial materials were used with the utmost economy. People performed miracles. In 1942 workers began digging foundation pits for factory shops; signs indicating the location of various production premises were stuck in the clearing still dotted with tree-stumps. Equipment was assembled in shops whose walls and roofs had still to be set up. Spidermen worked in freezing temperatures and hurricane winds. Fires were lit in shops to prevent pipelines from freezing. Sheds were made for some types of equipment and engines were placed in casings. In April 1943, the main sections of the alumina shop were check-tested and by the autumn of the same year it was already working at full capacity. But the following winter brought with it even greater difficulties. Taking into consideration that some solutions used in the production of alumina harden at $+32^{\circ}\text{C}$ it can be easily imagined how difficult work was in



A hospital township in Krasnoturyinsk

the calcination shop which had no walls while the temperature was way below zero.

There was no roof over the warehouse where bauxites were stored. Sodden from autumn rains the bauxite hardened into rock which had to be blown up.

Subbotniks were organised and the ore which was collected in bits was brought on litters to the grab crane. Wet bauxite was difficult to work with. It clogged up the equipment and the mass would not flow along the ducts. Engineers and technicians worked side by side with the workers performing heavy manual labour.

In less than four years a new town and factory appeared in the midst of the taiga.

In a short period of time the population of the Turyinskiye Rudniki mining township increased several times over.

At four in the afternoon on May 9, 1945, the day when the whole country jubilated over the surrender of nazi Germany, the Bogoslovsk plant produced its first aluminium.

Victory Day was a day of double victory for the workers of the Bogoslovsk Plant.

In November 1944 Turyinskiye Rudniki, an environ of the town of Karpinsk, became a separate town subject to regional authorities and renamed Krasnoturyinsk. That same year the North Urals Bauxite Mines township also became a town and was given the name of Severouralsk. The Urals Aluminium Plant developed into a large-scale metallurgical complex and the Bogoslovsk Aluminium Plant was greatly enlarged.

The labour battle for bauxite, for Urals aluminium is continuing with mounting success.

END OF THE TRIP

Sverdlovsk

How wonderful it is to be back home after a long journey, to be back in Sverdlovsk, the city from where all my trips began and where they came to an end.

There is a saying that each journey is made thrice: once in dreams, then in reality, and finally in reminiscences. All my trips were made four times: the fourth time was in this book which was first published here, in Sverdlovsk. And my narrative would not be complete if I did not describe, even though very briefly, my home town which is justifiably regarded as the heart of the Urals.

Ever since it appeared, this town in the upper reaches of the Isset almost at the border between Europe and Asia, on the eastern slope of the Ural Range, was called the fortress on the Isset, and though fortress towers, earthen ramparts and log walls have long disappeared, the town is still regarded as one of the country's citadels on the border between two continents.

The poet Mayakovsky called Sverdlovsk the "worker and warrior". A more fitting description would be hard to find. Formerly called Yekaterinburg, Sverdlovsk, the administrative and cultural centre of Sverdlovsk Region, was founded at the beginning of the 18th century.



Railway station square in Sverdlovsk

The city developed as the centre of a mining area. It was the site of the chancery of the Mining Superintendent who administered a vast and extremely rich territory, the size of an average European state. During the reign of Catherine II there was a mint where the Istorichesky (Historical) Square is now located. The Decembrists sentenced to hard labour in Siberia passed through Yekaterinburg on their way along the Siberian Tract. A memorial plaque on Tolmachev Street marks the site of a ramshackle wooden station where they stopped for a brief rest.

Yekaterinburg figured prominently in the history of class battles. One of the centres of the working-class movement in the Urals, it was the scene of major



Monument to Yakov Sverdlov

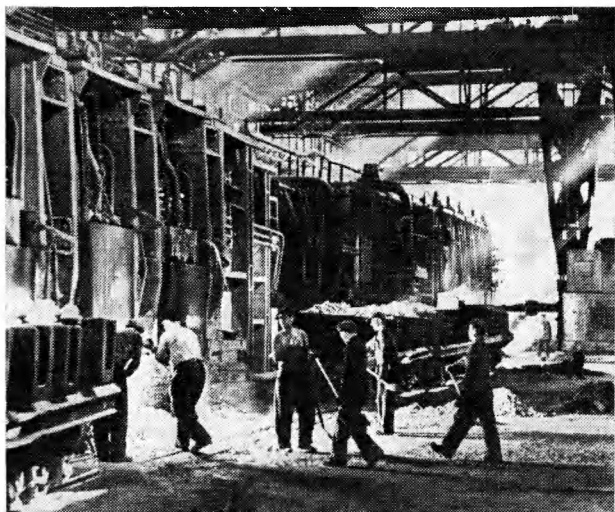
political demonstrations during the First Russian Revolution of 1905. One of the first Soviets of Workers' Deputies to be set up in the country was established in this town. In 1907 the local Bolsheviks launched the newspaper *Uralsky Rabochy* (Urals Worker) which is published to this day. Soviet power was proclaimed in Yekaterinburg on November 8, 1917, the day following the October uprising in Petrograd. Shortly, a large number of local workers went to the frontlines to defend the young republic.

In 1924, on the seventh anniversary of the October Revolution the town was renamed Sverdlovsk in honour of Yakov Sverdlov, the ardent Bolshevik revolutionary, first President of the Soviet state, Chairman of the Central Executive Committee and an associate of great Lenin, or Comrade Andrei as the Urals workers affectionately called him.

In the years of the country's rapid development Sverdlovsk changed beyond recognition. New bridges were built across the Isset and smooth asphalt roads replaced old cobble streets. Its population growth was tremendous. One of the biggest cities of the Soviet Union, Sverdlovsk has a modern public transport system and a dense network of everyday services. Today the township of the Sergo Orjonikidze Heavy Engineering Works alone is bigger than the Yekaterinburg of pre-revolutionary Russia.

Sverdlovsk's pride and glory is its industry. Its factories export their output to India (Bhilai), Egypt (Aswan), Poland, Bulgaria, Hungary and Cuba. Dozens of countries import rolling mills, blast furnaces and mining machinery bearing the trademark of the Urals Heavy Engineering Works, which the great proletarian writer Maxim Gorky called the "father of factories".

Sverdlovsk is a scientific and educational centre. It is the seat of the Urals Branch of the USSR Acad-



Foundry shop of the Verkh-Isset Iron and Steel Works

emy of Sciences and has more than 70 research and designing institutes.

On Lenin's initiative the Gorky Urals State University was founded in the city in 1920. It is also the site of the Urals Polytechnical Institute named after Kirov and the Mining Institute. These three institutions of higher learning have a total student body of some 35,000. All told, over 120,000 students are enrolled at the city's 11 higher and 28 secondary specialised educational institutions. Upon graduation young specialists are assigned to industrial enterprises and construction sites in the Urals, Siberia, the Far East and the northern regions of the USSR.

The Mining Institute's Geological Museum is justifiably regarded as one of the most interesting places in the city. It has a vast collection of Urals minerals, including iron and copper ores, potash salt, baux-

ites, asbestos, platinum, gold, diamonds, amethysts, topazes, beryls, tourmalines, chrysolites, rock crystal and many other gems and industrial stones such as jaspers, rhodonite, malachite. . . . It is impossible to list all its treasures. Yekaterinburg was a town of jewellers and their craft is still widely practised in Sverdlovsk.

The Picture Gallery has a fine collection of artistically molded iron objects made at the Kasli factory.

The celebrated Urals raconteur Pavel Bazhov lived for many years in Sverdlovsk. Here he wrote his *Malachite Casket* which has been translated into many languages. His house is now preserved as a memorial museum.

Sverdlovsk is also a theatrical town. In 1962 its Lunacharsky Opera and Ballet Theatre marked its fiftieth anniversary. In 1966, after one of its regular runs in Moscow, the word Academic was added to its name. Ivan Kozlovsky, Sergei Lemeshev, Irina Arkhipova, Boris Shtokolov and many other famous opera singers began their artistic careers on its stage.

There are also a drama, children's, puppet and musical comedy theatres in the city, a philharmonic society, a TV centre and motion picture studios producing feature, popular-science and documentary films, and a theatrical institute. Many young singers and musicians, graduates of the Sverdlovsk Conservatoire appear on the country's theatrical and concert stages. The Urals Folk Choir has won renown both at home and abroad. The Sredne-Uralsk Publishing House is one of the biggest in the Russian Federation. Two monthly literary magazines *Ural* and *Uralsky Sledopyt* (Urals Pathfinder) are published in the city, which is also the home of a fairly large number of writers, painters, sculptors and composers.

Standing in the zone of a sharply pronounced continental climate, in a picturesque area with a rugged



Monument to Pavel Bazhov



Sverdlovsk. Central Stadium. The skater is
Valentina Stenina

terrain, Sverdlovsk has all conditions for the development of a variety of sports, particularly winter sports.

The Uktuss Hills just outside the city limits are often the venue of major domestic and international ski contests. It is the site of one of the first ski jumps to be built in the country. A ski jump made of metal with a synthetic runway which is available for ski jumpers the year round was built next to it early in 1966.

Tatyana Karelina and Rimma Zhukova trained on the ice of the Sverdlovsk Dynamo Stadium.

Besides these two famous skaters Sverdlovsk has produced many outstanding sports personalities including Valentina and Boris Stenin, the golden couple as they are called, who twice won the titles of world champions and thrice the titles of champions of the USSR, the ski champion Klavdia Boyarskikh, the Nazmutdinov sisters, of whom Lydia, the eldest, became the Soviet Union's first Merited Master of Sports in eurythmics, and the Sverdlovsk Army Club team which won the national bandy championship eight times.

Football is very popular in the city. There are two factory elevens, the Uralmash and the Kalininets, both of which take part in league championships.

Sverdlovsk is steadily expanding. In the post-war years a covered skating rink with artificial ice, the first of its kind in the Urals, was built on the Young Pioneer Stadium. A children's railway was built in the Mayakovsky Central Park. The youth Palace of Culture and Sport currently under construction will have a concert hall seating 2,500 and a sports hall with an artificial ice track and stalls for 4,500 spectators.

Housing construction is being conducted at a great pace. About three million square metres of living space, several times the amount available in the city before the revolution, have been tenanted in the period from 1959 to 1965. Old log houses are being demolished and their inhabitants moved to modern apartments in new housing districts which have been built in the centre of the city and its outskirts.

Hunting, hiking and angling are a favourite recreation of many people. And there is absolutely no need to travel to some other part of the country, for

a typical Urals landscape with its forests, lakes, rivers and hills begins just outside the city. Moreover, there is fish in the pond situated opposite the City Soviet in the centre of the city.

Many places in Sverdlovsk and its environs are associated with the country's revolutionary history including the Kamenniye Palatki Cliffs where the workers of Yekaterinburg held their secret meetings and heard the fiery words of Comrade Andrei, and which have now been included into the memorial park zone, and the Sverdlovsk Museum housed in what had once been the premises of an underground revolutionary school.

Night and day beats the never-tiring heart of the giant city, and night and day blazes the eternal flame which Sverdlovsk, the worker and warrior, ignited at the foot of the obelisk in Communards Square, the last resting place of heroes of the Civil War and the Revolution.

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